Electrical World

A McGRAW-HILL PUBLICATION

Thorough Grounding
Pays Dividends

JANUARY 4, 1947

Features

Swiss Develop New Gas Turbines
Compulsory Arbitration Inacceptable
Joints Limit Overhead Conductor Ratings

to Streamline ELECTRICAL TEST PROCEDURE

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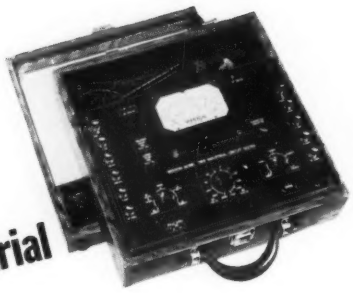

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Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 72 YEARS

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ELECTRICAL WORLD Published weekly. Price 35 cents a copy. Publication office 99-129 N. Broadway, Albany 1, N. Y. Allow at least ten days for change of address. Address communications about subscriptions to J. E. Blackburn, Jr., Director of Circulation. **Return Postage Guaranteed.** Subscription rates: In the United States, $6 a year, $9 for two years, $12 for three years. Canada $7 for one year, $11 for two years, $14 for three years (Canadian money at par). Pan-American countries $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in the U. S. A. Contents copyrighted, 1946, by McGraw-Hill Publishing Co, Inc. All Rights Reserved. Branch Offices: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W. C. 2; Atlanta, Ga.; Boston, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Washington.

McGRAW-HILL PUBLISHING CO., INC.
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Founder and Honorary Chairman

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Manson Tape

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A quarter-century after he purchased this roll of Manson Friction Tape, this customer* returned what little remained on the core for test. Here's the laboratory report:

"This is the oldest roll of Manson Tape . . . or any friction tape . . . which we have ever examined. This tape still has sufficient adhesion quality to stick and stay put when wrapped as on a joint or splice. There was insufficient tape remaining to conduct all tests. We did, however, make several tests given in ASTM Spec. for Friction Tape D69-28.

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"The tape withstood the ASTM dielectric strength test of 1000 volts without breakdown."

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If you'd like to know how to make a perfect splice, send for Booklet OK-1007.

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4843

Electrical World

JANUARY 4, 1947

The Hazards of Compulsory Arbitration

WHEN a labor dispute involves the public interest, as in the electric utility industry, it is often suggested that the parties should be required to submit the dispute to arbitration.

While such a solution sounds reasonable, those who propose it frequently do not appreciate its broad effects. When appraised of its pitfalls, they usually discard compulsory arbitration.

There are two difficulties with compulsory arbitration. First, collective bargaining demands made by unions are unlimited, and second, no limitations exist to the awards allowable.

Most advocates of compulsory arbitration consider wages only. Some advocate using public service commissions in utility disputes, arguing that "They fix the rates; let them fix wages affecting rates." But matters affecting wages may be less important than other demands.

Many electric utilities have chosen to use unit substations rather than assemble components. Suppose a utility union demands that the company forego unit substations as perilous to members' jobs—a common type of demand.

Would the proponents of compulsory arbitration prefer that a regulatory body, or any one else, settle this dispute? Under what rules? There are none! It would rest on social views, attitude toward "labor as the victim of the giant corporation," or toward "labor barons' outrageous demands," or some variant.

Suppose a union demanded strict seniority in promotions—right up to the grade of company president. Unions have already demanded and obtained strict seniority in promotions to the supervisory level. This makes length of service, not ability, govern promotions. Union demands being unlimited, why not demand strict seniority up to the presidency? Were compulsory arbitration the law, demands of this type would be arbitrable. Would compulsory arbitration advocates like such disputes to be settled by an arbitrator having no responsibility for results?

Is this far fetched? A reply by a manufacturing company president to a War Department telegram to "The Employees of ———— Company" led, during the war, to a union demand that he be disciplined. The union maintained that he had no right to speak for the employees, that only the union could do so.

Suppose a power company found power purchases cheaper than generation, but met union demands that it not purchase power without union permission. This type of demand—that no component be sub-contracted without union approval—is frequent.

The union might demand that electric meters be read twice as often. A milk strike threatened New York because the companies wanted everyday deliveries, the union every other day.

Suppose a union demands that all profits go to the union. The Duquesne Light union demanded 1/3 of the profits over 6 percent, the remainder to be refunded.

It requires little imagination to see that union leaders may demand anything, and that granting of their demands could destroy management's ability to manage a company.

In all such cases, the arbitrator has no restrictions to shape his decision. He should be impartial, a qualification often indicating unfamiliarity. He can only decide as his background and social views dictate.

If disputes affecting electric utilities be arbitrated, rules must control the arbitrator.

★ ★ NEWS OF THE

Industry Added 2,000,000 New Customers in 1946, Neff Says

E.E.I. President in Year-End Statement Declares That 1947 Will Add an Equal Number of Consumers—Sales Show Slight Decline from 1945 but Annual Revenue Increases 3 Percent

THE YEAR 1946 in the electric utility industry was a year of phenomenal growth in the number of customers served, Grover C. Neff, president, Edison Electric Institute, declared in a year-end statement released this week. Despite the housing shortage and difficulties encountered in procuring poles, wires, and equipment, nearly 2,000,000 new customers were added. A backlog of over 600,000 applicants for service, waiting for materials and availability of ample skilled labor, indicates that 1947 will match 1946 in new customers added. In a nation with 40,000,000 families, 90 percent are now using electricity.

Another high record established in 1946 was the increase in average residential consumption of electricity, an increase of 100 kw.-hr., to set a record high average of 1,330 kw.-hr. per customer. New consumption records were set by all classes of consumers except industrial.

Most New Customers Were Rural

Most of the new customers connected in 1946 were in the rural areas. Less than 400,000 of the residential customers originated within city limits. In excess of 500,000 farms were connected during the year, bringing the total number of electrified farms as defined by the U. S. Bureau of the Census to more than 3,400,000. This constitutes about 63 percent of all occupied farms. Already three-fourths of all farms are reached by electric power lines, though some 700,000 of those reached are not yet taking service.

Total sales of electricity by all utilities, both company and governmental, approximated 191,000,000,000 kw.-hr., compared with 193,558,000,000 kw.-hr. sold in 1945. Since the decrease was in industrial power use sold at wholesale rates, while retail uses of electricity increased, annual revenues did not decrease but instead increased by 3 percent to a total of $3,450,000,000.

During the year as a whole, the average residential customer increased his consumption of electricity by 100 kw.-hr., bringing the total to 1,330 for 1946. This gain sets a new record in the year-to-year increase in household use and compares with a 78 kw.-hr. increase in 1945 and 81 in 1944.

NO STRIKE, ARBITRATION — A. Augustus Low, left, vice-president of Consolidated Edison Co. of New York, and Patrick McGrath, business manager of the Consolidated Edison local of the Utility Workers Union, C.I.O., present Secretary of Labor Lewis B. Schwellenbach with an agreement to arbitrate their contract dispute. Secretary Schwellenbach has appointed Dr. George W. Taylor, a former chairman of the National War Labor Board, to serve as chairman of the arbitration board completed by Messrs. Low and McGrath

The price of electricity continued its decline, and the greatest number of rate reductions in recent years is indicated by the 4 percent drop during the year in the cost of gas and electricity as determined by the Department of Labor.

Production of power by all electric utilities—both business-managed and publicly operated—is estimated at 222,500,000,000 kw.-hr. in 1946. This is about the same as the 222,433,981,000 kw.-hr. generated in 1945. Of the total, 143,000,000,000 kw.-hr. were produced by steam, an increase of 2,500,000,000 units over the previous year. Hydroelectric production declined by 2,500,000,000 kw.-hr. to an estimated total of 77,500,000,000 kw.-hr., while generation by internal combustion engines was about the same as the 2,000,000,000 kw.-hr. of 1945.

Due largely to strikes in the metal producing industries and in the plants of the principal electrical manufacturers, barely 150,000 of the 1,400,000 kw. of generating capacity scheduled for installation in 1946 actually went into service during the year. On the other hand, the maximum demands on the generating stations are estimated to have increased by some 4,700,000 kw., and the margin of spare and reserve capacity, which stood at 9,300,000 kw. (or 23 percent of the peak requirements) in December of 1945, has been whittled down to 4,750,000 kw., or only 10 percent.

Much Construction Planned

The electric companies, however, plan to add about 8,500,000 kw. in capacity over the next three years—2,400,000 kw. in 1947, 3,500,000 kw. in 1948, and over 1,750,000 kw. in 1949. The combined orders of companies, municipal and other governmental power agencies, and of all industrial establishments for generating equipment for installation in the next three years has already reached the high total of 11,500,000 kw. to be added to a present combined total installation of 63,000,000 kw.

Except for power houses, the construction budgets planned by the utilities for 1946 were consistently carried out. Total expenditures by the business-managed companies, the municipal plants, and the rural cooperatives approximated $800,000,000 during the year. The outlook for 1947 is that this sum will be substantially exceeded.

ELECTRICAL WORLD ★ ★

Co-ops Warned They Face Domination by Washington

President Wilkes of Southwestern Gas & Electric Points Out Inroads in Co-op Affairs by Bureaucrats

Members of REA-financed rural electric cooperatives soon must choose whether to continue as "business-managed organizations" or be "completely dominated by . . . bureaus in Washington."

That was the substance of a letter written recently by Frank M. Wilkes, president of Southwestern Gas & Electric Co., to the managers of eleven rural co-ops which purchase power at wholesale from S.G.&E.

Charging that REA in Washington has been trying to "run down" the utilities which serve cooperatives, he deplored what he termed the "interference by federal bureaus" with the operation of the co-ops. The principal difference between established utilities and the cooperatives, he said, is that the utilities borrow from banks and the general public while the co-ops borrow from the federal government.

"As long as we meet our interest charges," he added, "our bankers have no authority over our actions—as long as you meet your fixed charges, there should be no interference by federal bureaus with your operation."

Southwest's Rates Are Low

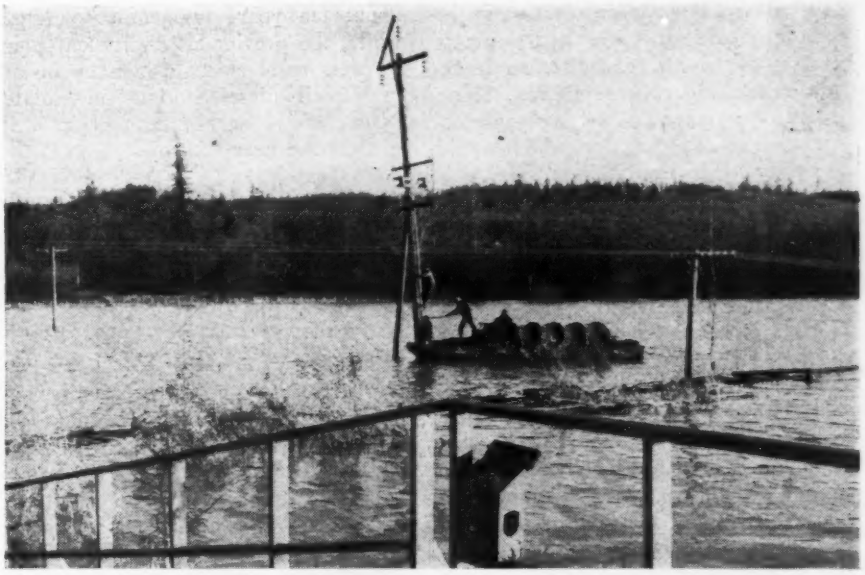
The Wilkes letter was accompanied by a report on a recent survey made by the Georgia Public Service Commission of wholesale rates charged rural electric cooperatives by public and private agencies. It pointed out that the S.G.&E. average rate of 5.6 mills per kw.-hr. was lower than any covered by the survey except the Bonneville Power Administration rate of 4.105 mills.

Comparing these rates with that charged by the Tennessee Valley Authority—6.688 mills—Wilkes declared that retail rates of TVA-served cooperatives are limited to 3 cents per kw.-hr., "so that the cooperatives in the Tennessee Valley are doomed to perpetual servitude to the Public Power Trust."

Also included with the letter to the co-op managers was a copy of a proposal submitted by twelve electric utilities to the Southwestern Power Administration, recommending the sale to the companies of all energy produced at hydroelectric projects under SPA jurisdiction.

"You will note," Wilkes told the managers, "this proposal carries with it the passing on to the cooperatives all of the benefits that can possibly be derived by them from this power, without the extension of a single mile of transmission line, either at governmental expense, or at the expense of the cooperatives."

The company plan would make unnecessary the "gigantic project" for linking these dams with federal transmission lines, as contemplated by SPA, Wilkes said.



SERVICE IN FLOOD TIME—When the Green River began to flood the valley south of Seattle, Wash., officials of the Puget Sound Power & Light Co., realizing the danger to distribution lines in the area, persuaded the Army to lend them two "ducks," complete with drivers. The vehicles proved their worth to company crews patrolling flooded areas. Here a lineman climbs a pole to do some work at a site about two miles south of Renton on the East Valley highway

•

Must Pay Tax on Water

Public utility companies are liable for the payment of the Missouri sales tax of 2 percent on water purchased for use in connection with the generation of power, the St. Louis counsellor has advised the city water commissioner. Utilities are exempt from payment of the tax on fuel, but the counsellor takes the position that water isn't fuel.

Tennessee Valley Public Power Association Formed

Public power executives of three states met in Nashville, Tenn., on December 6, to lay the groundwork for organizing a Tennessee Valley Public Power Association. S. R. Finley, general superintendent of the Electric Power Board of Chattanooga, and chairman of the organizing committee, said that the membership in the proposed association will be open to executives of 150 non-profit power operatives in the Tennessee Valley.

Mr. Finley declared that the association will have two aims:

1. To increase distribution and utilization of electric power purchased from the Tennessee Valley Authority.

2. To coordinate activities of organizations already active in the TVA area.

Organizations whose activities would be integrated by the Public Power Association include: the Tennessee Valley Electric Institute of Mississippi and West Tennessee; the Middle Tennessee Managers Association, the North Alabama Distributors Association, and the Eastern Division Power Distributors Association.

FOREIGN POWER NOTES

Japan . . . To limit Japan's capacity for making war, the United States has proposed that of 282 thermal power plants with over 4,000,000-kw. capacity, 140 with 2,000,000-kw. capacity be removed; and of 1,057 hydro plants with 6,000,000-kw. capacity, an undetermined number be removed. There would be no specific "ceiling" on electric equipment production, which would be controlled by limitation on steel.

A 50-DAY DISPUTE between employees and management of Japanese utilities was settled early in December when a government-supervised agreement was reached giving the employees, members of the All Japan Electrical Workers Union, an increase in pay. It is estimated that workers will now receive average monthly pay of 2,000 yen (about $135), 20 percent less than the figure demanded. The dispute was marked by daily blackouts from 8:30 a.m. to noon daily in Tokyo, and nationwide blackouts had been announced when the agreement was reached.

India . . . An unsatisfied demand, now estimated at more than 10,000,000 light bulbs, has brought the establishment at Madras of the Madras Electrical Industries, Ltd., which expects to be producing 10,000 bulbs daily by the end of 1947. Prices of bulbs are extremely high; a 200-watt bulb costs slightly more than $2.00. Bulb factories are making large profits. One, the Mysore Lamp Works, Ltd., as of June, 1945, showed earnings of 25 percent on paid-up capital, and in five years had established reserves more than equal to capital.

ESTABLISHMENT of a provincial power grid is under preparation by the government of Bombay Province to permit wider utilization of existing supplies of electricity and to develop new sources.

In its preliminary stages, the plan calls for early completion of two 15,000-kw. steam turbo generating plants near Ahmedabad to supplement the 37,500-kw. steam station now existing and setting up a network over the northern section of the province. In addition two 7,500-kw. stations are to be established near Surat.

Central Bombay Province is to be supplied by better distribution from the three stations of the Tata Hydroelectric Agencies, which now have a combined capacity of 230,000 kw.

In the southern part of the province, plans are being pressed for construction of a major hydroelectric project at Koyna to supply increased industrial needs, but this is expected to take about ten years to complete. Meanwhile, the provincial government plans to press rural electrification by installing small diesel stations in isolated places which cannot be tied into the grid in the near future.

Poland . . . Electric output in Poland is expected to reach 5,000,000,000 kw.-hr. in 1946, and officials expect this total to rise 1,000,000,000 kw.-hr. annually until 1949.

Philippines Republic . . . Consumption of electric power in Manila rose from 6,699,000 kw.-hr. in January of this year to 9,133,000 kw.-hr. in June, and is still rising.

Mexico . . . The Mexican Government's agency for electrification (Federal Electricity Commission) has just made public its electrification program for the coming six-year term, 1947-1952.

Total investment in the building of electric power plants planned for this period amounts to 800,000,000 pesos (over $180,000,000), with a total capacity increase of 1,140,000 hp.

New or enlarged plants are planned in all the 28 Mexican states, but the main projects will be built in the following states:

Puebla, 135,000 hp.; Mexico, 135,000 hp.; Guanajuato, 60,000 hp.; Durango, 75,000 hp.; Coahuila, 66,000 hp.; Jalisco, 71,000 hp.; Michoacan, 77,500 hp.

Financing of the projects is to be assured by yearly federal subsidies, the 10 percent federal tax on all electricity consumption, and by the sale of electric power by the government-owned plants already functioning.

South Africa . . . A new record for electricity output has been established by the semi-State Electricity Supply Commission during 1945. The total reached 4,861,400,000 units, exceeding the previous year's total by more than 317,640,000 units.

•

Voters Down Town Plant

Voters of Eureka, Kan., served by the Kansas Electric Power Co., recently rejected a $240,000 bond issue for a municipal electric plant.

I.B.E.W. Calls 1st Contract with Union Electric, 'Model'

The first contract signed by the Union Electric Co. of Missouri with the International Brotherhood of Electrical Workers, A.F.L., has been hailed by the union as a "model." The contract, effective as of October 1, does not cover wages, which will be taken up in separate negotiations beginning next January.

The closed shop contract covers hours and working conditions of 1,100 workers in the sytem including those in the Alton and East St. Louis, Ill., Keokuk, Iowa, and St. Louis areas.

This is the first contract the company has had with the brotherhood because it did not win bargaining rights until an NLRB election was held last summer. Previously there had been an independent union and later a C.I.O. union.

Main features of the contract are provisions for a three-week vacation with pay for workers with 15 years of service and two weeks for those with service of one to 15 years; prohibition of strikes until full grievance procedure, including use of services of the U. S. Conciliation Service, is followed; regular linemen not to be called out in bad weather, but trouble shooters are subject to duty at all times; sick leave on a sliding scale based on length of service up to two months; double pay for holidays when worked; time and four-fifths for all work after a regular 8-hour day; seven holidays a year with pay; and a 40-hour week.

•

Utility Property Priced

The price which the Klickitat County (Wash.) Public Utilities District must pay for the Pacific Power & Light Co. facilities in the county has been set at $670,070 by a federal court jury at Yakima. The P.U.D. had offered about $500,000, and the utility had wanted about $1,000,000. If there is no appeal, it is up to the district to decide on whether it wants to carry out the purchase at the price set by the jury.

•

Rural Loans Granted

The Rural Electrification Administration in October announced loans totalling $32,626,000 to 95 cooperatives, four public power bodies, and a private utility, in 30 states. Most of the loans were for the construction of lines, of which 19,304 miles are to be built to serve 55,927 customers.

Hill Succeeds S. B. Williams as Editor of Electrical World

Publisher Will Exercise Over-All Supervision of Editorial and Business Operations of Magazine—Former Editor Named Manager of Customer Relations for Sylvania Electric Products

LEE H. HILL

SAMUEL B. WILLIAMS

LEE H. HILL, since September 1, 1945, publisher of ELECTRICAL WORLD, has also been named editor of the magazine, succeeding Samuel B. Williams, who has resigned to become manager of customer relations for Sylvania Electric Products, Inc.

Mr. Hill will continue as publisher of ELECTRICAL WORLD and *Electrical Contracting*, exercising over-all supervision of editorial and business operations of the two magazines.

Before joining the McGraw-Hill Publishing Co., Mr. Hill spent a quarter of a century in the electrical industry, achieving broad experience in such of its varied phases as education, product design and development engineering, sales and engineering management, and industrial relations. He has been granted more than 40 patents on electrical equipment developments and has contributed extensively to the literature of the transformer as well as to that of the labor and industrial relations fields. During his career in electrical manufacturing, Mr. Hill came to be regarded as an authority on transformer design. As a result of his later experience, he has become preeminent in the field of labor and industrial relations.

Mr. Hill is a Fellow of the A.I.E.E., a former director of the American Management Association and was long active in NEMA, particularly in its Transformer and Feeder Voltage Regulator Sections. He was for many years a member of A.I.E.E.'s Transformer subcommittee, and is a former chairman of its Sharon and Milwaukee Sections.

During the war, he served both as alternate and full industry member of the War Labor Board and was an alternate management delegate to President Truman's Labor-Management Conference of 1945. He has spoken and written widely in this field and is co-author of "Management at the Bargaining Table," a McGraw-Hill book. He is author also of another volume in this field, "Pattern for Good Labor Relations," to be published soon. He wrote the section, "As Management Sees It," in "The Wagner Act after Ten Years." In addition, he is a member of the Secretary of Labor's Technical Advisory Committee to the U. S. Conciliation Service.

Mr. Hill was graduated from Cornell University in 1922 with an E.E. degree. He served as an instructor in electrical engineering there for two years. Then he joined the Westinghouse Electric Corp. as a transformer design and development engineer. In 1928, he joined American Brown-Boveri, and was manager of its transformer division when it was taken over in 1931 by Allis-Chalmers Mfg. Co. In 1936, he became manager of Allis-Chalmers' transformer division in charge of sales and engineering. Later he became assistant manager of the firm's electrical division.

Following the 76-day strike at Allis-Chalmers in 1941, which was of such consequence to the budding defense program, Mr. Hill was selected to organize the company's first industrial relations department and elevated to a vice-presidency as an indication of the importance of the new group. In this capacity, Mr. Hill had direct responsibility for labor relations, employee training, wage policies, employment, and safety, medical, and other employee relations programs.

Mr. Williams was graduated from Princeton University with the degree Lit. B. in 1912 and E.E. in 1914. Immediately thereafter, he joined ELECTRICAL WORLD and served as editorial representative, statistical editor, commercial editor, and news editor before rising to the assistant managing editorship. In 1922, he became managing editor of *Electrical Record*. Two years thereafter, he resigned the editorship of *Electrical Record* to become editor and manager of the *Electragist*, later *Electrical Contracting*. He remained as editor until December, 1936, when he returned to ELECTRICAL WORLD as managing editor. Two years later, he became editor of ELECTRICAL WORLD.

Mr. Williams has taken an active part in association work both in the electrical industry and in the business paper industry. He is a member of the A.I.E.E. where he has had many committee assignments and is a past-president of the Illuminating Engineering Society. For several years he was secretary of the Committee of Awards of the James H. McGraw Awards for Electrical Men.

In his new capacity, Mr. Williams will engage in public relations and association work for Sylvania.

•

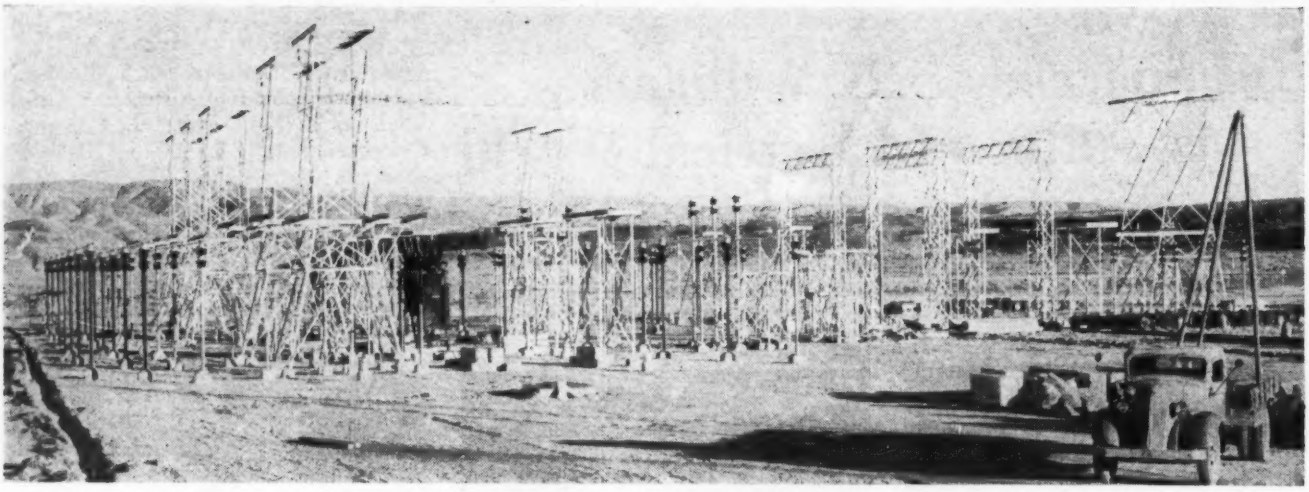
New Interconnecting Lines

Delaware Power & Light Co.'s West Substation in Wilmington was connected recently with the company's new substation at Dover, Del., by a new 66-kv. line. Interconnecting with this line is a new 22-kv. line of the Eastern Shore Public Service Co. of Maryland which ties in with new substations at Massey and Millington, Md.

•

P.P.D. Must Keep System

Voters of Osceola, Neb., have defeated a proposal of the Consumers Public Power District to sell its distribution system to the town, which would then have been forced to buy its power wholesale from the P.P.D.



TO BETTER SERVICE IN IDAHO—Part of Idaho Power Co.'s $6,000,000 expansion program is this 40,000-kva. substation nearing completion at the terminus of the company's new 90-mile, 138-kv. transmission line from the Upper Salmon project on the Snake River, second unit of which is to go into operation shortly. The new substation will be operated by supervisory control from the main dispatching center in Boise, four miles distant

Arizona Utility Asks Court to Stop Co-op's Expansion

Central Arizona Light & Power Co. has asked the Maricopa County Superior Court to enjoin the Ma-Yu Electric Co-operative, Buckeye, Ariz., from extending any of its lines into the area served by the utility.

The action followed an announcement by the co-op that it had been granted a loan of $790,000 by the Rural Electrification Administration and would start construction of 400 miles of power lines in western Maricopa and eastern Yuma Counties. The co-op also plans to build its own generating plant, as officials say that the utility has refused to supply power at wholesale rates.

Central Arizona Light contends that the co-op is a public service body under Arizona law and thus comes under the jurisdiction of the state corporation commission, but has no certificate of convenience and necessity from the commission as has the utility to serve the particular area in dispute.

The utility claims that service is being extended to the area as fast as materials can be secured to do the job and that the construction of parallel and duplicating lines by the co-op would be an economic waste.

•

New Division Organized

Georgia Power Co. has set up the Community Development division to combine and correlate the activities previously handled separately by the Industrial Development and the Better Home Towns divisions.

The new division will be headed by George H. Broadnax, Jr., who has served as field supervisor of the Better Home Towns program since its inception. M. L. Wilson will be manager of the Industrial Development section.

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'45 Utility Plant Investment Put at $14.5 Billion by FPC

The Federal Power Commission has revealed in its report of the financial statistics of 342 business-managed electric utilities for 1945 that investment in plants at the end of the year was $14,490,782,000 or less than at any time since the end of 1940. At the end of 1944 the figure was $14,754,097,000. The decrease was attributed by FPC to write-offs and elimination of intangibles brought about by its efforts.

Further increases were also shown in reserves for depreciation, and the aggregate of reserves for the industry at the end of 1945 was $3,064,919,000 or 21.2 percent of utility plant. Net plant, or total recorded investment less depreciation reserves, amounted to $11,425,863,000 at the end of the year.

•

Municipal Adding Unit

Abbeville (S.C.) Water and Electric department will place a 1,200-kw., diesel-driven unit in operation early in January. Added to the present hydro units, the new unit will give the system a capacity of 3,800 kw. and will make it unnecessary for the department to purchase power from the Greenwood County Electric Power Commission (Buzzard Roost).

Missouri Co-ops Exchange Areas to Better Operation

With a view toward greater centralization and more economical operation, several cooperatives in southwestern and central western Missouri are reassigning their service areas.

Southwest Electric Cooperative, Bolivar, will acquire by assumption of debt 73 miles of lines serving 216 customers in Polk County from the Ozark Electric Cooperative of Mount Vernon. Southwest will also construct 338 miles of new lines serving 1,105 new customers and will complete lines previously approved by the Rural Electrification Administration.

Webster Electric Cooperative, Inc., Marshfield, will acquire through assumption of debt about 100 miles of lines serving 304 customers in Bolivar, Webster, and Dallas Counties from Southwest, and 120 miles of lines serving 450 customers in Christian, Greene, and Webster Counties from Ozark. Webster plans to construct 223 miles of lines serving 517 customers.

Other lines of Ozark are to be taken over by the Osage Electric Cooperative, El Dorado Springs, which recently was allotted an REA loan of $228,000. It will build 154 miles of new lines in Cedar County.

•

Will Add 20,000-Kw. Unit

The Luzerne County Gas & Electric Corp., Kingston, Pa., has begun an expansion program calling for an expenditure of $3,740,000 for additional equipment at its Hunlock Creek station. A 20,000-kw. steam unit is included.

REA Statement Reveals Standing of Loan Funds

Has Advanced Only $595,000,000 to Borrowers—$118,000,000 Left Not Enough to Make Loans Asked

With an apprehensive eye on an apparently economy-minded Congress, the Rural Electrification Administration has compiled a financial statement indicating that the recent REA appropriations for loans—$550,000,000 in the past two fiscal years—have been no more than enough to meet borrowers' demands.

Released to the press this week, the statement estimates that REA had allocated a total of $957,000,000 for Rural Electrification loans from the agency's inception in 1935 to the close of the 1946 calendar year. This figure compares with a total of $1,075,000,000 received during the same period by the agency in Congressional appropriations and authorizations for lending purposes, leaving some $118,000,000 not actually obligated by loan contracts.

REA spokesmen say that they expect to allocate a large portion of this carry-over during the remaining six months of fiscal 1947, pointing out that, as of December 31, 1946, REA had pending loan applications totaling more than $225,000,000.

REA admits that, of the total of $957,000,000 allocated for loans, only $595,000,000 actually has been advanced to borrowers. REA advances loan funds only as needed by borrowers to pay for construction. Shortages of electrical equipment and construction materials have prevented a large number of borrowers from going ahead with projects months after loans to finance such work have been approved by REA.

Taber Criticizes REA

This lag in time between approval of loans by REA and actual use of the funds was roundly criticized recently (ELECTRICAL WORLD, November 30, 1946, Page 5) by Rep. John Taber, New York Republican and probable new chairman of the House Appropriations Committee. At that time, Congressman Taber declared that he was "confident" that REA had received more funds for loans in the past two fiscal years than it could lend out in five years.

Pointing to recent rises in costs of construction materials, he said it was "uneconomical" for REA to grant loans for work which could not be completed in the near future.

On the other hand, REA officials maintain that supplies of materials needed by its borrowers have become more abundant in the past few months. They emphasized that borrowers energized approximately 50,500 miles of new power distribution lines during calendar 1946, as against 39,000 miles during calendar 1945. Though meters and transformers still are in insufficient supply, manufacturers predict increased production of these items during the first quarter of 1947, REA says.

As equipment has become available, loan funds have been advanced more rapidly. During calendar 1946 REA advanced some $131,000,000 as compared with $57,000,000 in 1945.

Approximately $109,000,000 of the loan funds as yet unallocated are from the $250,000,000 authorized by Congress for loans during fiscal 1947, the last regular fund authorization received by the agency. The remaining $9,000,000 of unobligated funds were carried over from previous authorizations.

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New Utility Authorized

Clinton Light & Power Co. has been authorized to offer utility services at Clinton, B. C., by the Public Utilities Commission. Two small diesel plants which have been offering services became inadequate as population has increased.

East Tennessee Counties Want More TVA 'Taxes'

A delegation from 35 counties in east Tennessee has asked Gov. Jim McCord to indorse legislation which would give counties additional funds from revenues received from the Tennessee Valley Authority in lieu of taxes. Judge Floyd Knight, of Dayton, chairman of the delegation, said that the legislation would be retroactive to the time the TVA made the first payment to the state.

During the past fiscal year TVA paid $295,319 in revenues, and of this amount counties received $118,127, or about 40 percent of the total. Judge Knight said that the proposed legislation would give counties approximately 60 percent of the total to "take the place of taxes we lost when the TVA took over property in the respective counties."

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Not Department Head

James B. McCurley, who recently was named chief of the technical standards division of the Rural Electrification Administration, was formerly acting head of the electrical engineering committee at the United States Naval Academy and not acting head of the electrical engineering department as stated in ELECTRICAL WORLD, Nov. 23, Page 88.

FOR POWER FROM SHASTA—Mayor Harold T. Johnson of Roseville, Calif., turns the first shovelful of earth for the installation of giant steel towers on Oroville-Sacramento transmission line of the Central Valley project, a line to bring power from Shasta dam. With him are Ben W. Creim, center, regional power director for the Bureau of Reclamation, and Irving C. Harris, Bureau construction engineer in charge of building the line. Roseville was the first city to contract directly with the Bureau of Reclamation for Shasta power

New Line Assures Power for Erecting Davis Dam

A contract for construction of a 69-kv. transmission line from Kingman, Ariz., to the Davis damsite has been signed, thus assuring adequate power for construction of the dam.

The bid accepted for the 28-mile line by the Bureau of Reclamation was $91,969 submitted by Donovan, Inc., St. Paul, Minn.

The new line will connect with the Citizens Utilities Co. system 1½ miles northwest of Kingman. It will be 3-phase, single-circuit, 60-cycle line with H-frame wood-pole construction.

Actually the new line is a safety measure since a 69-kv. line serviced by California-Pacific Utilities Co. is already installed on the Nevada side. After the Colorado River has been diverted, electrically driven pumps will keep the foundation area free from water. Failure of these pumps during foundation installation would cause costly delays, making the standby power a necessary precaution.

In addition to furnishing emergency power for construction operations at the damsite, the line will be used to transmit power to the Mohave Electric Cooperative for consumption at Bullhead City, home of many workers engaged in Davis Dam construction.

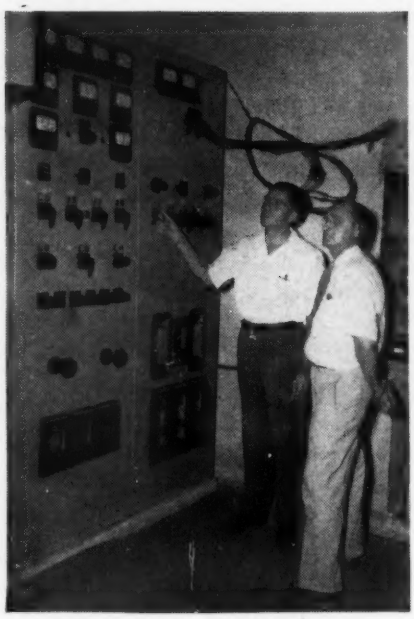
•

Ontario, New Brunswick Short of Water for Power

Shortage of water has imperiled the production of power in the Province of Ontario, Canada, and in New Brunswick. In both places recently, government authorities called for conservation of power and added in explanation that the war, strikes, and material shortages had slowed expansion programs.

In Ontario, the Hydro-Electric Power Commission, which supplies most of the province, called upon all municipalities to ban daytime billboard and sign illumination and store window lighting. Citizens were asked to place a blackout on Christmas tree decorations before December 21 and after January 1. The possibility of reintroducing "daylight" or "fast" time was being considered.

In New Brunswick, J. G. Boucher, chairman of the New Brunswick Electric Power Commission, advised elimination of show window and outdoor display illumination. He warned that rationing may be resorted to, as the commission's plants are overloaded between 4 and 9 p.m. daily. Increased consumption is creating voltage trouble.



ON THE LINE—Superintendent O. F. Patton gets ready to throw the switch to put the Riviera plant of Florida Power & Light Co. on the line for a test. The plant is at Palm Beach and is now in operation. With Mr. Patton is J. G. Alusas, Westinghouse Electric Corp. engineer on the project

MEETINGS

Edison Electric Institute—Prime Movers Committee, Van Curler Hotel, Schenectady, N. Y., February 3-4; Industrial Power and Heating Section, Hotel Continental, Kansas City, Mo., February 5-7; Transmission and Distribution Committee, Atlanta Biltmore Hotel, Atlanta, Ga., February 10-11; Meter Committee, Robert Treat Hotel, Newark, N. J., February 10-12; Electrical Equipment Committee, Atlanta Biltmore Hotel, Atlanta, Ga., February 12-13. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

Missouri Valley Electric Association—Annual Power Sales Conference, Hotel Continental, Kansas City, Mo., February 5-7. I. D. Pettegrew, director, 1004 Baltimore Ave., Kansas City 6, Mo.

Association of Edison Illuminating Companies—Committee on Metering and Service Methods, joint meeting with E.E.I. Meter Committee, Robert Treat Hotel, Newark, N. J., February 10-12. George B. M. Robertson, chairman, Philadelphia Electric Co., 1000 Chestnut St., Philadelphia, Pa.

Pennsylvania Electric Association—Systems Operation Committee, Lord Baltimore Hotel, Baltimore, Md., February 13-14. H. W. Phillips, chairman, Philadelphia Electric Co., 1000 Chestnut St., Philadelphia, Pa. Electrical Equipment Committee, Penn-Harris Hotel, Harrisburg, Pa., February 20-21. J. S. Brown, chairman, Duquesne Light Co., 435 Sixth Ave., Pittsburgh 19, Pa. Transmission and Distribution Committee, Penn-Harris Hotel, Harrisburg, Pa., February 20-21. C. C. Farrell, chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia 5, Pa.

Previously Listed

Canadian Electrical Association—Winter conference. Chateau Frontenac, Quebec, January 13-15.

Agricultural Development Clinic—Fairmont Hotel, Fairmont, W. Va., January 24-25.

American Institute of Electrical Engineers—Winter meeting, New York, January 27-31.

Electrical Engineering Exposition—71st Regiment Armory, New York, January 27-31.

Utilities' Land Condemned for Public Power Project

The government won another round last week in its move to continue construction of the Clark Hill power project when Federal Judge C. C. Wyche announced that he would sign a motion to give the government immediate possession of title to 1,532 acres of land in McCormick County, South Carolina. The sum which the government will pay for the land will be decided later.

Four tracks of land were involved, two of them owned by the Savannah River Electric Co., which has waged a fight for private development of the flood control and power project. The other owners include the Augusta (Ga.) Power Co., Grace E. Pearson, of Greenville, S. C., and Addie E. Hagan, of Due West, S. C.

Federal Judge Frank M. Scarlett heard arguments in the land condemnation case, and at the conclusion indicated that an order would be issued giving the government immediate possession of the property.

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Sabotage Cuts Service to 3 Strike-Bound Users

Rifle bullets, fired into Los Angeles Department of Water and Power transformers, cut off, in whole or in part, the electric power supply to three motion picture establishments in the Los Angeles area early in December, according to reports filed with police.

The three firms, all involved in the Conference of Studio Workers Union strike, are the Consolidated Film Industries, Inc., a laboratory; Pathé Industries, Inc., a laboratory; and the RKO studios. When department workers arrived at the RKO studio to repair the damage, they were greeted by pickets and the city employees, themselves members of a unit of the striking unions, left the scene. City officials later arranged for restoration of service.

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Miami Votes Utilities Tax

Miami, Fla., voters approved 4,920 to 4,262, on November 27, a sliding scale excise tax on all utilities bills. The levy had been approved by the City Commission last July, but petitions brought it to a vote. Less than 19 percent of the city's 46,731 voters cast ballots. The tax amounts to 10 percent on all bills under $25, 5 percent on the next $75, and 1 percent on all over $100.

SEC RULINGS

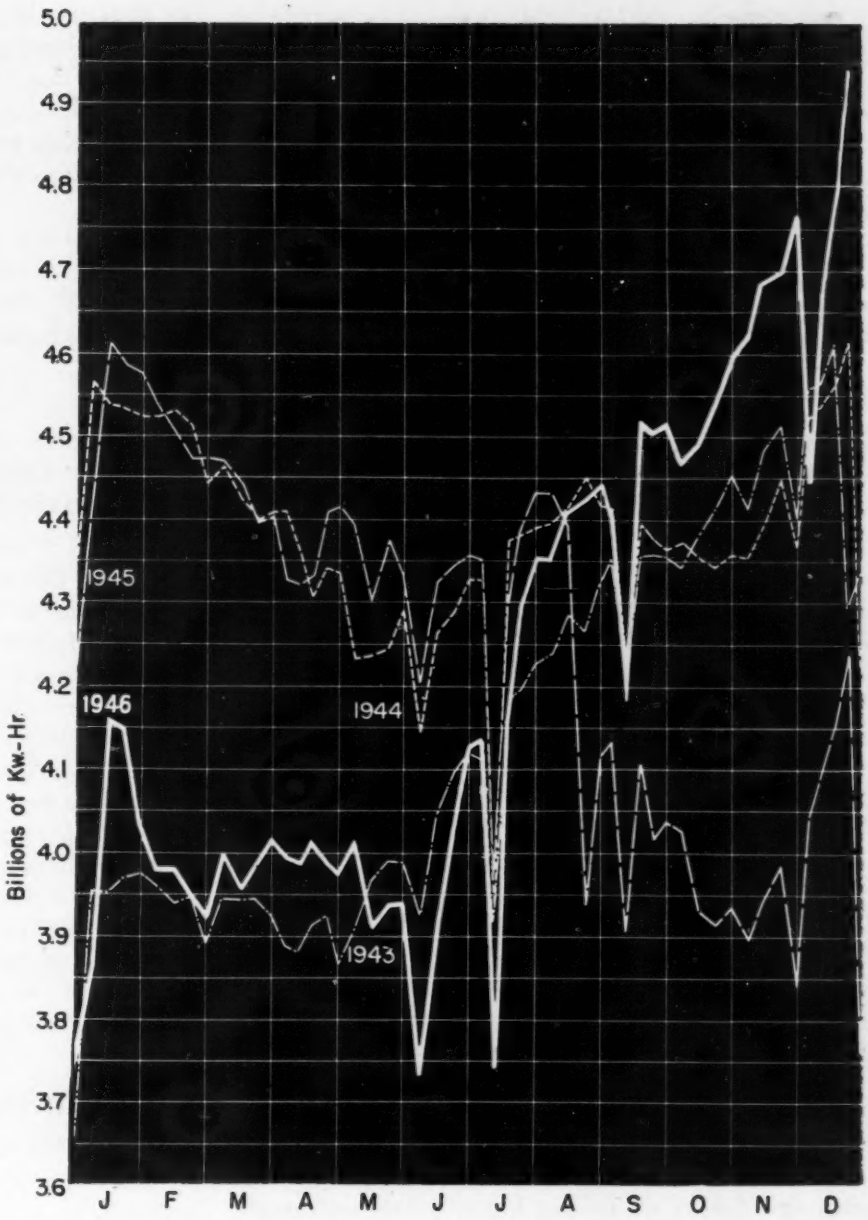
The Securities and Exchange Commission recently issued a series of orders affecting utility companies.

PORTLAND ELECTRIC POWER CO.'s amendments to its reorganization plan providing for reallocation of cash and securities have been approved. This action followed the sale last August of Portland Electric Power's holdings of Portland Traction Co. and an interurban railway for $7,966,750. The original plan was approved by the commission on January 14, 1946, and by the district court of Portland, Ore., on June 29, 1946. Treatment of security holders of Portland Electric Power as provided in the amendments approved by the commission follows: For each $1,000 principal amount of 1934 bonds and accrued interest, $680 in cash and 34½ shares of Portland General Electric Co. common; for each $1,000 of 1937 bonds and accrued interest, $594.80 in cash and 30 shares of Portland General Electric common; holders of prior preference stock would receive 6⅔ common shares and holders of the first preferred stock would get ⅔ of a share of Portland General Electric for each share and accrued dividends. (Release No. 7057).

HUDSON RIVER POWER CORP. and SYSTEM PROPERTIES, INC. proposed reorganization and merger into the newly formed Eastern New York Power Corp. has been approved by the commission. It was approved also in Boston by Federal Judge Francis J. W. Ford. Under provisions of the plan, Hudson River and System Properties will eliminate their indebtedness to their parent, the International Hydro-Electric System, and Eastern will issue first mortgage sinking-fund bonds and preferred stock to refund first and refunding 5 percent sinking-fund mortgage bonds, due on January 1, 1947, of the International Paper Co. The latter were assumed by Hudson River. (Release No. 7042).

INTERSTATE POWER CO.'s proposal to sell its electric generating and distributing properties in South Dakota to five rural cooperatives for a base price of $950,000 has been approved. In addition, Interstate plans to sell to the purchasers—Rosebud Electric Association, Inc., Clay-Union Electric Corporation, McCook Electric Association, Inc., Sioux Valley Empire Electric Association, Inc., and Turner-Hutchinson Electric Association, Inc.—certain current assets relating to the South Dakota properties for an amount to be determined upon the consummation of the transactions, which will be financed by the Rural Electrification Administration. (Release No. 7069).

STANDARD GAS & ELECTRIC CO.'s application for authority to sell under competitive bidding conditions 140,614 shares of common stock of Mountain States Power Co., a subsidiary, on a day to be determined by Standard Gas, has been approved. Net proceeds from the sale will be used by Standard Gas to make payments of interest and principal on its promissory notes, dated April 10, 1946, issued to banks under the bank loan agreement dated December 21, 1945. (Release No. 7061).



Output Hits New High in Pre-Christmas Week

Moving sharply upward, the electric output curve reached a new high record during the week ended December 21, 1946, according to figures released by the Edison Electric Institute.

The amount of electrical energy distributed by the light and power industry during the week amounted to 4,940,453,000 kw.-hr., the previous high being 4,777,943,000 kw.-hr. for the week ended December 14. The Southern States reported the highest individual increase, 25.5 percent.

During the week ended December 22, 1945, the amount of electrical energy distributed totaled 4,239,376,000 kw.-hr., this year's figure representing an increase of 16.5 percent.

Data covering output for the week ended December 28 are omitted this week because of inability to get figures in time for publication.

Weekly Output, Millions Kw.-Hr.

1946		1945		1944	
Dec. 21	4,940	Dec. 22	4,239	Dec. 23	4,617
Dec. 14	4,778	Dec. 15	4,154	Dec. 16	4,563
Dec. 7	4,673	Dec. 8	4,097	Dec. 9	4,538
Nov. 30	4,448	Dec. 1	4,043	Dec. 2	4,524
Nov. 23	4,765	Nov. 24	3,841	Nov. 25	4,369
Nov. 16	4,700	Nov. 17	3,985	Nov. 18	4,450
Nov. 9	4,682	Nov. 10	3,948	Nov. 11	4,397
Nov. 2	4,628	Nov. 3	3,899	Nov. 4	4,355
Oct. 26	4,602	Oct. 27	3,937	Oct. 28	4,358
Oct. 19	4,540	Oct. 20	3,915	Oct. 21	4,345
Oct. 12	4,495	Oct. 13	3,934	Oct. 14	4,355
Oct. 5	4,478	Oct. 6	4,028	Oct. 7	4,375

Percent Change from Previous Year

	Dec. 21	Dec. 14	Dec. 7
New England	+11.7	+11.3	+10.1
Mid-Atlantic	+ 9.1	+ 6.4	+ 3.9
Central Industrial	+15.3	+13.5	+11.3
West Central	+11.4	+11.0	+ 9.3
Southern States	+25.5	+21.2	+22.1
Rocky Mountain	+ 7.2	+ 9.5	+ 9.7
Pacific Coast	+23.1	+26.1	+27.8
Total United States	+16.5	+15.0	+14.1

Electrical World
OPINION

Disarming Competition

ONE UNTOWARD ASPECT of service interruptions or threats to continuity arising from major system mishaps, violent storms and floods and strikes is the sudden emphasis placed on auxiliary generating equipment by power users whose needs are imperative. Power companies seem to be unusually sensitive about such interest lest it turn into a disposition to look upon the alternative aids as potentially permanent substitutes. Well they may be when they are told that one in every six owners of expensive homes along the seaboard is considered a definite prospect for standby electric equipment by those who make and sell such facilities.

First and foremost that asserted statistic is not a very good commentary on the public's appreciation of the degree of continuity of service rendered even in such semi-detached territories. The first and foremost answer is to publicize how good the reliability of service really has become in recent years—to mansions and hovels alike.

But there will still be dozens of enterprises that are convinced that their operations will not tolerate even a brief interruption. Alphabetically they run—airports, bakeries, canneries, poultry hatcheries, community freezers, department stores, drawbridges, pumping stations, sports arenas, theaters, etc. The degree of insistence in each case hinges on process losses, public regulations, management caprices and, not to be ignored, ignorance of the economic facts. They do not generally have the same access to A.S.M.E. reports of diesel operating costs and other sources available to the utilities.

Therein lies the most likely antidote: Instead of sitting back helplessly and hopelessly facing a feared growth in adoption of back-up units for such requirements, the reaction could better be—why let competition get the jump on us? Why not canvass the entire system to identify users who could legitimately or even erroneously fall prey to over-aggressive selling of such units? That would put the power company in at least as good a position as its competitors as far as one item goes and that would be knowing where to concentrate the program of educating the users about the indisputable facts and about the inescapable economics. It might be illuminating to learn why power company customers who have no sound excuse for any back-up supply "fall" for the blandishments of the salesman. It would be even more constructively helpful to discuss the issue frankly with the customer. If he really needs the service insurance then the opportunity is afforded to show what the power company itself has to offer by way of fortified supply. If that is impracticable the next logical move is to offer collaboration with the "diesel man" and thus win his friendship as well as that of the customer. There certainly are diesel-electric producers who would cooperate.

All this reads a bit different from the coarse political expression "if you can't lick 'em, join 'em," but it does try to indicate that belaboring is weak by comparison with "colaboring" and that amiability can be gratifyingly disarming.

Tougher Competition Looms for Electric Water Heaters

COMING UP behind bottled gas there is to be seen what looks like another competitor of the electric water heater. This is forced-draft combustion designed into automatic heaters for domestic applications. This new development, some forms of which are now, or soon will be, on the market, is bringing the sizes of heating units down to unbelievably small dimensions. At present intended for house heating, it certainly will not be long before these new devices will be adapted for water heating. With that prospect ahead, it seems that if the electric utilities really want the water heater load they had better get busy on it pretty soon, in regard both to promotion of the service and to standardization on a few heater designs for volume production and resulting lower prices of the heaters.

The Small Rural Transformer

AT THE RATE consumptions on the farms are growing, one has to be almost a dismal pessimist to pin either a manufacturing or an installation program on transformers of 1- or 1½-kva. sizes. The optimistic view puts the emphasis on the 3-kva. size as the logical minimum for mass production and broad application.

But, just as in the cities, there will be some few users whose circumstances or choice will keep them in the low-consumption brackets. Wherever that prospect can be ascertained with certainty it would be disadvantageous to put in a 3-kva. unit for a nominal demand of, say, only 1 kva. because the core losses of the unnecessarily large unit would eat into the returns from such a low use customer as well as waste some small amount of added investment. Capitalization of the losses when added to the small unwarranted extra investment in the copper and iron of the larger unit could, in other terms, make the slimly profitable user a definitely unprofitable one. The real remedy is to coax the customer upward in usage.

But granting still that there will be some who will stay small there is, then, a degree of justification for using a limited number of 1- and 1½-kva. transformers for

rural distribution. How much justification there is for producing them in quantity will hinge on the number now in service that will be released by the rural loads that do grow. Those particular ratings seem to have much more stamina than the abortive 600-watt transformers and may prove to be a drug on the market for several years.

Reflections on an Annual Report

IN the days when the company's business was no one else's business, the annual report was prepared in a time-hallowed formula of accountant's jargon that none except the initiated were expected to understand. The figures arrived at, checked and attested, nothing more remained but to pour them into the hopper for mechanical distribution to the proper lines and spaces of debits and credits, liabilities and assets, income and expenses, and, lo, the annual report was finished. The result was to most people an effective way of concealing information, which was as it should be because, after all, it wasn't any of their business.

Among the first to realize that the company's business was also the business of anyone who chose to be interested in it and that interest in it should be cultivated and encouraged, were the electric utilities. More than 15 years ago a few power companies began to translate into the vulgar tongue the esoteric terms and phrases by which accountants proved that they were different from other men. Then, like boys testing the ice with careful steps to see if it would hold their weight, some began to include in their reports information that had nothing directly to do with profit and loss, gross and net, but was of value in presenting a more complete picture of the company and its operations than was possible with figures alone.

The idea that the annual report should be more than an accountant's statement has been variously expressed, sometimes well and clearly in pertinent and competent presentation, other times in hodge-podge fashion comparable to poorer examples of Chamber of Commerce publicity pieces. In its old form as simply a device of bookkeeping, the annual report was presented in a definite, prescribed formula, but a formula has not yet been developed for the modern kind of report. Let's hope there never will be. Its freedom from the requirements of form is perhaps the most engaging characteristic of the modern report.

A good example of a report free in style and really informative in content—good looking, too—is that of the Dayton Power & Light Co. There are a number of other electric utilities that are doing the same thing. But too many are still sticking to the old dry-as-dust formula, thereby possibly reflecting a dry-as-dust kind of thinking in top places that is an anachronism in this day of recognition that anybody's business is everybody's business if everybody so wills it.

WASHINGTON COMMENT

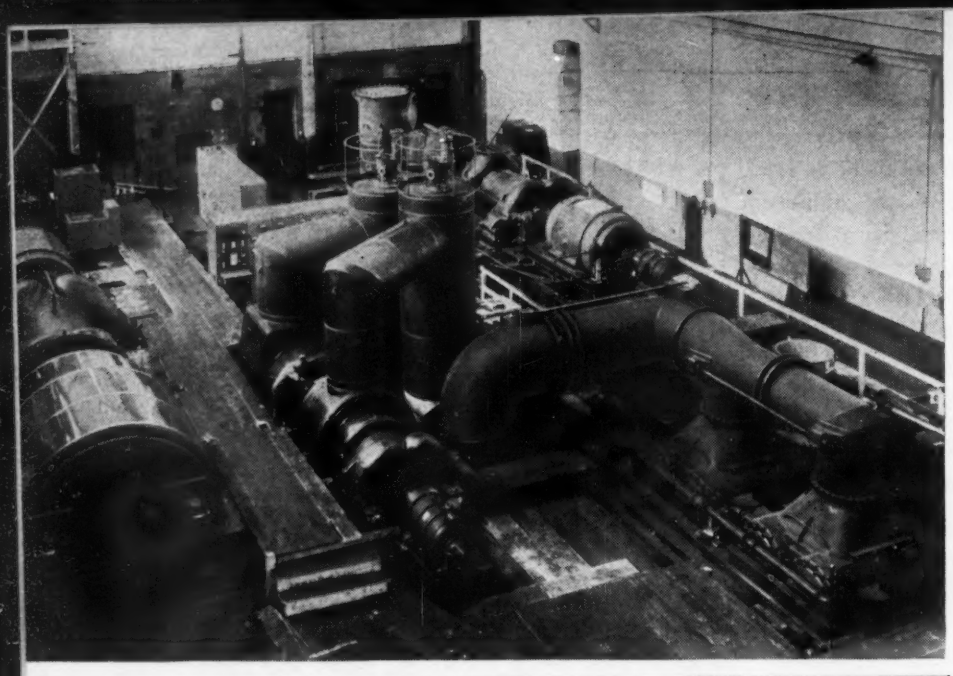
By R. N. LARKIN

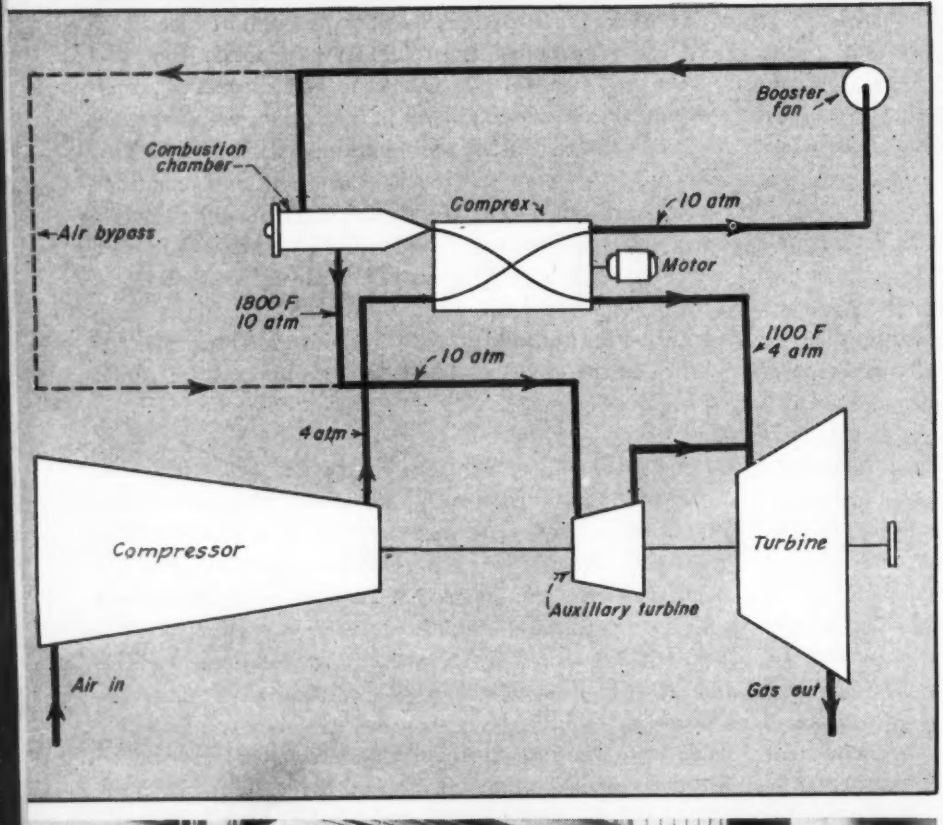
WHETHER for reasons of legislative strategy or because it has been reading the election returns, the Interior Department will not ask the 80th Congress immediately for legislation specifically authorizing it to erect steam-electric plants in conjunction with its far-flung hydroelectric power marketing jurisdiction.

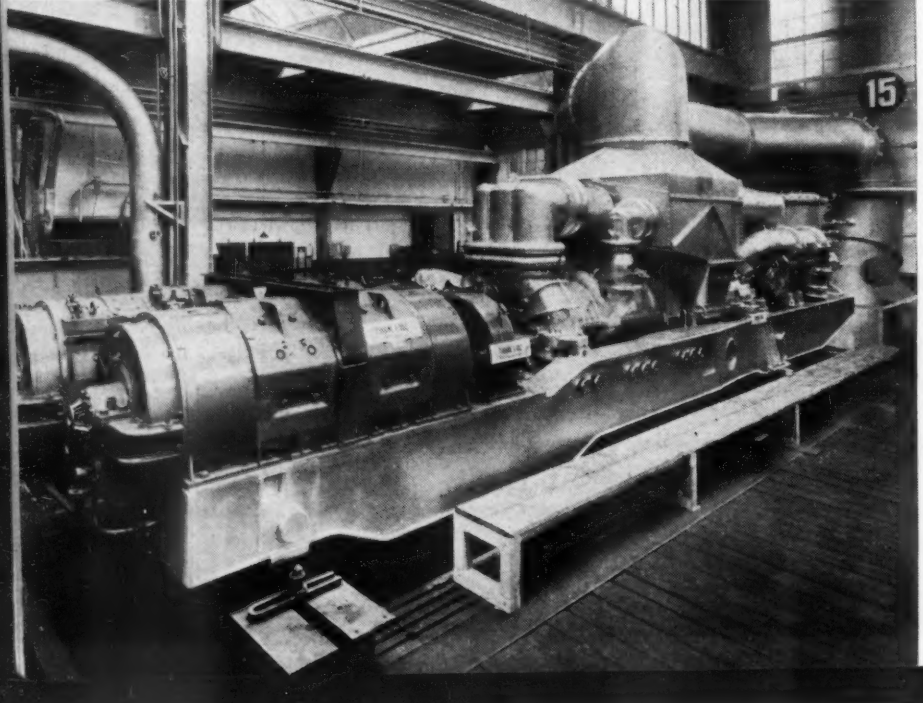
That Congress would be asked to grant the department such authority, either on a project by project basis, or on an area basis, or on a national basis, was apparent last June when the department's interpretation of Section 5 of the Flood Control Act of 1944 was rejected. That section, which gave Interior marketing jurisdiction of Army-developed energy everywhere in the nation, was construed to authorize the construction of steam-electric plants. This interpretation was specifically rejected, and conceded erroneous by Sen. Carl Hayden, the department's principal Senatorial protagonist. Since SPA's 20-year program depended upon steam capacity, and since its prospects of getting such back-up were slim without specific legal authorization to build it, SPA and Interior expansionists confirmed the obvious—that specific authorization would be sought.

Interior's policy-makers do not say now that they will never present and push such legislation. They assert only that it will not get immediate or early presentation. The reason for this is interesting, but less important than the fact that, unless plans change and such a bill be introduced promptly, consideration of the next appropriation for SPA will be uncluttered by the steam plant argument. The fight, then, will revolve around extension of SPA's transmission system. Once again, then, the long-standing but never settled argument about federal steam plants will be avoided, pushed aside unresolved. This fight has been raised and dropped without settlement at least four times since 1941.

One power policy issue which will be acted upon by the 80th Congress is that concerning how Interior's power program should be carried on during an era when the accent is on economy. There are authorized today many more projects than Interior will this year be given money to build. On some of these, construction has begun. How then should the available funds be distributed? Interior would prefer to finish those under construction, but it fears that sectionalism and pork-barrel considerations will lead Congress to spread the money as widely as possible. To minimize this, it has not asked funds for unstarted projects. Whether this strategy will be effective remains to be seen. Such a policy is opposed to that of the Army Engineers, who try to keep as many projects as possible busy.







Swiss

BASED on completion of exhaustive tests on two standby gas-turbine sets, Brown Boveri has undertaken construction of two base-load machines of 13,000 kw. and 27,000 kw. for installation at Beznau, Switzerland. These are the largest units yet under contract. Delivery of the smaller unit is scheduled for fall of 1947 and the larger machine is to be ready before winter of 1948.

In all, twelve gas-turbine sets are now in various stages of design and construction (Table I). Most interesting of these from a technological standpoint is a 3,000-kw. experimental power unit intended for locomotive service. A pressure exchanger, entirely new in gas-turbine application, acts as a second-stage booster compressor to increase output approximately 50 percent over that of a simple open-cycle unit. Tests are now in progress.

With the exception of this experimental unit, all machines are being designed for relatively conservative temperature of 1,100 F., well within the capabilities of available materials. Sizes range from 1,200 kw. to 27,000 kw.

Already completed and dismantled for shipment is a standby gas-fired power unit for Filaret station in

LARGEST power unit (top) yet completed, this 12,000-kw., two-stage, standby machine tested 14,800 Btu. per kw.-hr. at full load

SCHEMATIC DIAGRAM of new pressure exchanger (Comprex) with auxiliary turbine. Combination adds about 50 percent to output of open-cycle gas turbine

LOCOMOTIVE power unit, 3,000 kw., showing Comprex booster at right. A comprehensive test program is now in progress

Develop New Gas Turbine Units

ADOLPH MEYER, *Brown Boveri & Co., Baden, Switzerland*

Completion of tests on 12,000-kw. gas-fired unit for Rumania and 4,000-kw. single-shaft machine for Peru pave way for 40,000-kw. winter-power installation in Switzerland, locomotive drive with pressure booster

Bucharest, Rumania, (Fig. 1) to be installed alongside two 9,000-hp. diesel sets and one 6,000-hp. engine already converted for gas fuel. Since it is intended only as standby, the gas turbine has no regenerator. Initial cost, primarily controlling element in the design, is less than would have been necessary to convert the two large diesels for natural-gas firing.

The 4,000-kw. set for Chimbote, Peru, (Fig. 4) represents nearly the largest size single-shaft machine yet possible for direct connection to 3,600 rpm. generators for 60-cycle power. This unit, like that for Bucharest, is intended for standby and peak-load service, hence has no regenerator. Fuel cost is not a prime consideration.

Eight of the twelve machines now in various stages of manufacture at Baden (Table I) will have regenerators and will be designed for more or less base-load operation. Thermal efficiencies range from 22 percent (15,500 Btu. per kw.-hr.) for small units at full load up to 34 percent (10,040 Btu. per kw.-hr.) for the 27,000-kw. winter-power unit under favorable conditions with cold air.

Both Beznau machines are intended for base-load operation during winter months when river runoff is low and supply of electrical energy is limited. With mean air-inlet temperatures averaging 41 F. and with expected operation for considerable periods at even lower levels, high output and excellent efficiency can be built into relatively simple gas-turbine units. The larger generating unit utilizes many of the individual parts of the Bucharest machine by double-ending the low-pressure compressors and turbines.

An experimental unit of about 3,000-kw. output has been completed and awaits tests. Suitable for locomotive drive, this machine employs a "booster" stage with a newly developed "pressure exchanger" (Comprex) working (Fig. 3) on an entirely different principle from common forms of the gas turbine.

This power unit, shown schematically in Fig. 2, employs essentially the same compressor and gas turbine as the first 2,500-hp. locomotive. Exhaust from the compressor, however, passes to the pressure exchanger where its pressure is boosted from 4 atm. to more than 10 atm. After air leaves the pressure exchanger, a small gas-turbine driven fan adds a small increment of pressure to make up for losses in the pressure-exchange cycle and to aid in scavenging.

Practically all the air goes to the combustion chamber where temperature is brought to approximately 1,800 F. Main portion of hot gas passes to the pressure exchanger, which is essentially a volumetric device. The same volume of gas and air are handled by the pressure exchanger, leaving an excess of high-pressure gas resulting from the expansion caused by heating.

The excess gas flow is available for use in an auxiliary turbine. However, this part of the flow must be tempered from 1,800 F. to a value suitable for the auxiliary turbine by relatively cold air bypassed around the combustion chamber. Sufficient cold air is mixed to hold exhaust temperature from the auxiliary turbine about equal to that of main flow from the pressure exchanger to the main

Table of Gas Turbines in Manufacture by Brown Boveri, Switzerland

CLIENT	LOCATION	TERMINAL OUTPUT, KW.	THERMAL TERMINAL EFF., %	SUCTION AIR TEMP., DEG. F.	REMARKS
Corporation Peruana del Santa	Chimbote, Peru	4,000	18	68	Single-stage gas turbine
Lima Light, Power and Tramways Co.	Lima, for Santa Rosa Power Station, Peru	10,000	27.5	86	With heat exchanger, 2-stage gas turbine
C. A. Venezolana de Cementos	Caracas for Pertigalete Power Station, Venezuela	1,650	22	95	With heat exchanger, single-stage gas turbine
C. A. Venezolana de Cementos	Caracas for Pertigalete Power Station, Venezuela	1,650	22	95	With heat exchanger, single-stage gas turbine
Anglo Iranian Oil Co.	South Iran	4,000	18	95	Single-stage gas turbine
Anglo Iranian Oil Co.	South Iran	4,000	18	95	Single-stage gas turbine
Raymond Arcache and Co.	Alexandria, Egypt	1,200	23	77	With heat exchanger, single-stage gas turbine
Altos Hornos de Viscaya	Baracaldo, Spain	2,000	25	68	With heat exchanger, steel-mill blower set
Northeast Power Co.	Beznau, Switzerland	13,000	30.6	41	With heat exchanger, 2-stage gas turbine
Northeast Power Co.	Beznau, Switzerland	27,000	34	41	With heat exchanger, 2-stage gas turbine
Brown Boveri	"Comprex" test-unit	3,000	23	68	Two-stage gas turbine with pressure exchanger
Great Western Railway	England	2,500	....	68	Similar to Swiss locomotive

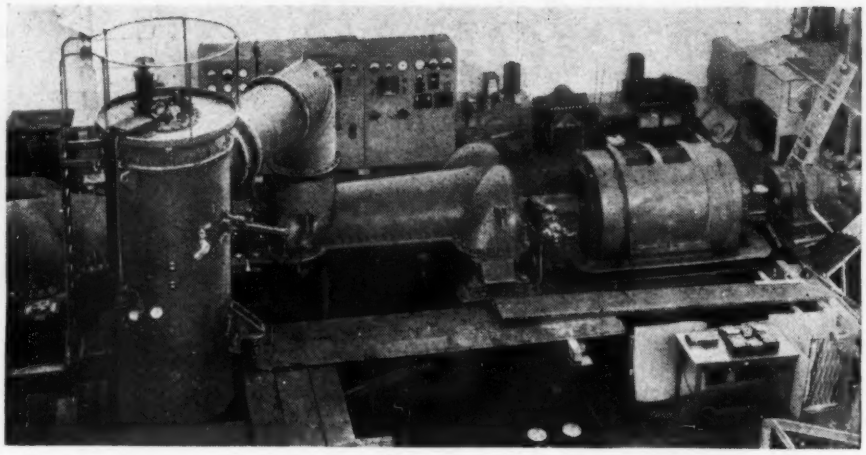
turbine unit of the generating set.

In effect, the pressure exchanger serves as an added stage of compression between pressure levels of about 4 atm. and more than 10 atm., utilizing a "piston" of hot gas to compress a charge of relatively cold air. The pressure exchanger is a rotating cylinder carrying a number of helical, longitudinal cells in which successive charges of air are trapped.

In principle, the Comprex acts the part of a pneumatic ram. As air enters an individual cell at high velocity, a pressure wave is built up by closing off the far end of the cell length. Part of the charge of trapped air is valved off at high pressure at exactly the correct time, leaving the remainder of the trapped charge at relatively low pressure. The cell now passes another fixed valve plate and receives another charge of hot gas, which is made to expand by an impulse pressure wave to become, effectively, a "hot-gas piston" compressor.

The Comprex has only a single moving part, the rotor itself, driven at constant speed by a motor. At a circumferential speed of about 650 ft. per sec., the individual cells pass the fixed valve plates at a rate of 3,000 per sec. so that the resulting gas and air flows are practically continuous. During each revolution of the rotor, each cell at one time or another contains air at compressor outlet temperature, about 400 F., combustion gas at 1,800 F., and the working fluid at intermediate temperatures corresponding to the compression and expansion. However, so rapid is the transition of each cell from compressor to expansion that the metal temperature departs from an average of about 1,000 F. by less than 2 F. It is estimated that temperature changes in the rotor of the Comprex penetrate less than 0.004 in. into the metal walls of the cells.

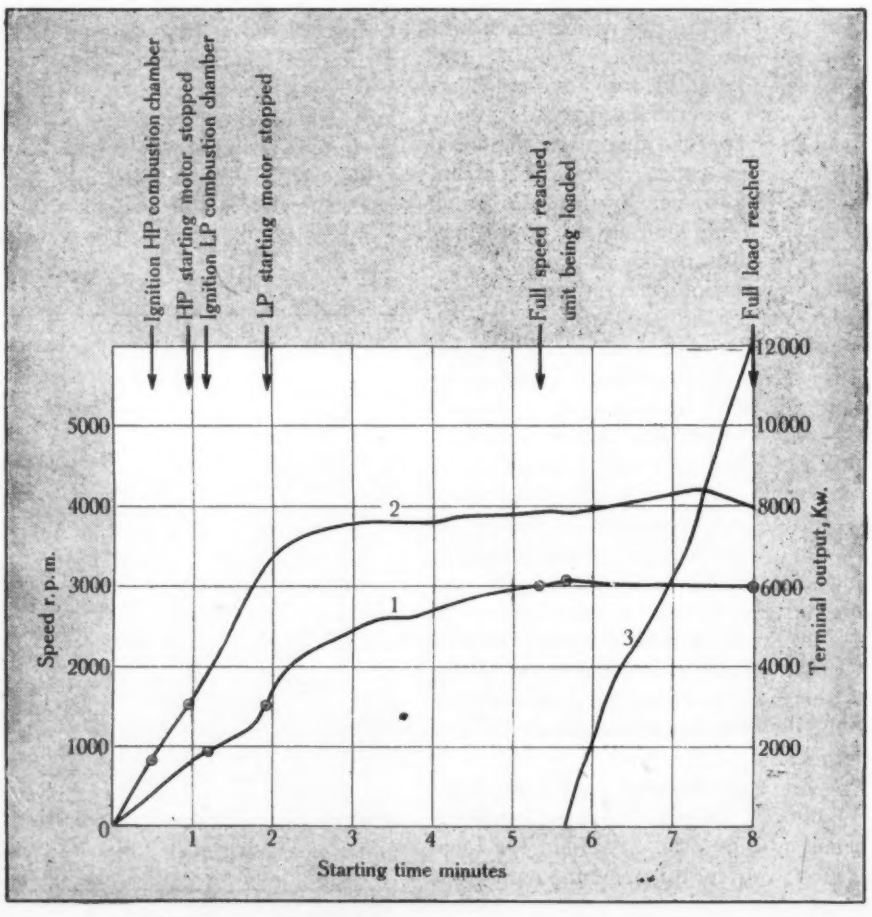
Cell division walls are given a helical twist to prevent segregation of heavier cold air and lighter hot gas because of centrifugal action. Inlet and outlet nozzles also are curved surfaces to supply desired velocity and direction of air and gas in and out of the rotor, but no appreciable exchange of energy between fluid velocity and mechanical torque is involved. In other words, the compressor action takes place entirely within an individual cell, and expansion follows within the same cell at a later time, all without conversion of heat energy into mechanical work as in the conventional turbine-compressor combination. Thus separate efficiencies for compression and expansion cannot be measured, but the combined efficiency is given as 69 percent.



SINGLE-SHAFT, 4,000-kw., oil-fired standby power unit ready for shipment to Chimbote, Peru. Direct connected generator turns 3,600 rpm.

First application of Comprex will be to the locomotive power plant where space and weight are at a premium. Maximum increase in power and efficiency over simple open-cycle gas turbine is effected in such applications where no regenerator or only one of small surface is possible.

TYPICAL start-load procedure from cold to full load requires eight minutes. Unit has been started on test bed more than 30 times



Anti-Strike Plan Generally Approved

OPERATING company executives and non-utility labor relations experts expressed general approval of the plan for elimination of utility service disruptions due to labor disputes, which was advanced in ELECTRICAL WORLD'S October 26 issue by Publisher Lee H. Hill.

Almost none found the plan without merit. A substantial number of the 78 comments endorsed it without reservation. About half suggested qualifications or exceptions which they felt would strengthen the plan, or cited reasons why they felt it would never be put into effect.

Reaction of labor leaders, including officials of unions actively engaged in representation of utility workers, is being sought, but is not included.

The most pronounced sentiment among those not endorsing the plan without reservation was the feeling that no such program could succeed without further legislation.

Legislation Necessary

Sixteen of those who commented, including ten operating companies, took this view. Most of them based their feeling on the imbalance of the Wagner Act. There was wide-spread agreement that service-disrupting strikes must be outlawed.

Only one comment took a vigorous stand against further legislation.

The next suggested agreement on a qualification of the program came with respect to a fundamental aspect of the plan—that of tying utility wages and working conditions to the area average and requiring that they match such standard.

There were two aspects to the qualification expressed in this regard. Nine comments indicated the feeling that such a principle would freeze utility wages and working conditions at existing levels, or that it would hamper efficient utility management. Nine other comments indicated that it would be difficult to determine area standards against which utility wages and working conditions could be measured. Two of the first group of exceptions were raised by operating electric utilities, one of which wants its employees to be the best paid in its area. Of the latter group three were operating electric utilities.

Next most popular exception noted in the comments was the belief that unions would not accept any such plan. Eight respondents expressed this belief specifically.

Eight respondents, including two operating companies, indicated that the settlement of utility labor disputes might well be left to special tribunals, labor courts, or state regulatory commissions. Most of these indicated that the job could be done within the framework of the plan.

Six of those who commented expressed the feeling that the plan should be broadened to apply to other industries wherein work stoppages have an effect on the public comparable to utility service disruption.

Four respondents, three of them operating companies, raised the point that it would be very difficult to apply the plan to a system which served at once in metropolitan and rural areas when these areas cover substantial territory. In such cases, the area standards might vary widely within a single system.

In this connection, some mention was made of the case of systems which operate in areas dominated by a single industry—coal, for example—whose wage rates or working conditions might be so overpowering as to distort the utility pattern.

Utility Extras

Four respondents, none of them operating companies, expressed a feeling that it would be difficult to include in any area standard the "extras" associated with utility employment—steadiness of work, pensions, etc.

Three respondents suggested that the plan would be strengthened by provision for taking speedy account of changes in the cost of living.

Throughout the replies there was evident a strong feeling that the plan had considerable intrinsic merit but that even if it had none, its publication was of service through stimulation of thought and discussion on one of the most pressing topics now facing utility management.

Compulsory Arbitration Unacceptable

THOSE WHO COMMENTED upon the plan for utility labor peace advanced by Publisher Lee H. Hill in ELECTRICAL WORLD for October 26 agree with him in being strongly opposed to compulsory arbitration of utility labor disputes.

Considering only those replies which unequivocally opposed it, 32 of 78 respondents came out flatly against imposition of compulsory arbitration. Four comments favored compulsory arbitration, two of them by operating companies.

Comments on compulsory arbitration included:

"You simply can't have compulsory arbitration in a free economy."

"I am convinced that if we erect compulsory arbitration, we shall find that honest, responsible and genuine collective bargaining will disappear."

"Arbitration would get to be a racket under a compulsory statute."

"Compulsory arbitration can only lead to the government taking over both the management of industries and of unions."

JOINTS and HARDWARE Limit

LEONARD M. OLMSTED. *Division*

JOINTS and conductor-supporting hardware in many cases restrict the safe ratings of open-wire copper conductors to values well below the capability of the conductors as established by annealing. Sturdy mechanical connectors reach temperatures at which contact oxidation is probable if operated at more than 75 percent of the current capability of hard-drawn copper conductors. Magnetic heating of malleable iron suspension clamps raises the conductor temperature as much as 30 C. and necessitates de-rating as much as 18 percent to avoid excessive annealing of the hard-drawn copper within the clamp. Optimum utilization of the thermal capability of copper conductors can be accomplished safely only after these auxiliary devices are made more adequate.

Thermal Capability of Conductors

Prior to 1939, Duquesne Light Co. ratings were based upon 50 C. temperature rise in still air, giving 400 amp. for No. 4/0 bare stranded copper conductors. Early in 1939 it became apparent that system loads were approaching the point where the loss of one generating unit or transmission circuit would impose loading upon the remaining circuits in excess of existing ratings, and a 20 percent increase was authorized for winter operation. The No. 4/0 conductors thus received a 480-amp. winter rating.

During this period, a detailed investigation of the temperature limitations of hard-drawn bare stranded copper conductors was in progress. This work indicated that copper anneals at temperatures far lower than had been suspected, and it appeared expedient to develop a time-temperature limit which would preserve sufficient tensile strength and elasticity to maintain design sags and clearances. The limiting annual equivalent copper temperature for 20 years of continuous 100 percent load-factor operation was indicated as 47.5 C., with some additional heating allowed for infrequent emergency overloading. The corresponding current capability

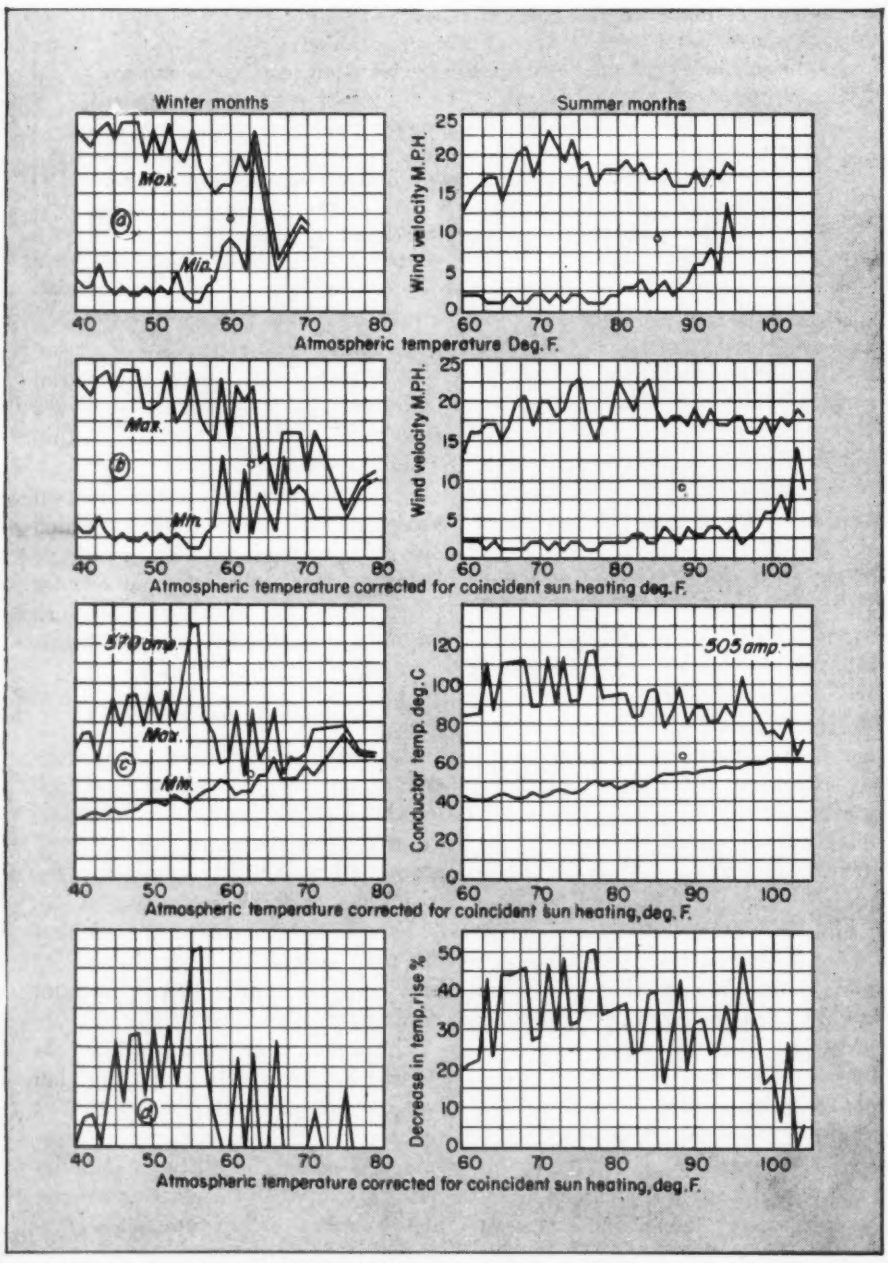

Winter months
Summer months
Max.
Min.
Wind velocity M.P.H.
Atmospheric temperature Deg. F.
Atmospheric temperature corrected for coincident sun heating deg. F.
570 amp
505 amp
Conductor temp. deg. C
Atmospheric temperature corrected for coincident sun heating, deg. F.
Decrease in temp. rise %
Atmospheric temperature corrected for coincident sun heating, deg. F.

FIG. 1 — Temperature of No. 4/0 HDB Copper conductor at normal current capability and decrease in rise required to limit joint temperatures to 70 C. Small circles represent seasonal equivalent effective temperatures

a. Correlation of wind velocity and air temperature

b. Wind, air temperature and sun heating

c. Conductor temperature at normal current capability

d. Decrease in temperature rise at joints to operate at limit of 70 C.

Overhead Conductor Ratings . . . I

Engineer, Duquesne Light Co., Pittsburgh, Pa.

Current carrying capability of conductors found substantially limited by present inadequancy of devices—Seasonal and emergency limitations established—Effect of air movement and sun and of contact surface oxidation—Practicability of compression splices indicated

of No. 4/0 bare stranded copper was determined as 435 amp.*

Cyclic and Seasonal Capabilities

Further investigation of the same nature, combined with stress-strain tests on conductor samples after various periods of heating at temperatures between 41 and 208 C., indicated that the annual equivalent conductor temperature might be raised to 52.5 C., giving a 100 percent load-factor current capability of 480 amp. These values were increased for normal system load factor to 59.0 C. and 535 amp. The duty on the conductors can be apportioned between winter and summer as required to suit operating conditions, the data in Table I being typical.

Preliminary Operating Ratings

These current capabilities are based upon the assumption that the conductors themselves are completely sound and free from broken or arc-pitted strands, inadequate joints, and heat-increasing supporting hardware. There must be sufficient tower height to maintain ground clearances at the greater sags caused by higher conductor temperatures, and all associated terminal equipment must have corresponding current capabilities. Until all such factors have been investigated, it seems advisable to limit operating ratings to 80 percent of the above current capabilities, giving values as shown in Table II for No. 4/0 hard-drawn bare stranded copper conductors in long-span construction fully exposed to prevailing winds and air temperatures. While these ratings may appear conservative, comparison of the values during a 24-hour emergency with the 400-amp. limit formerly in effect indicates an increase of 36 percent. Similar ratings enabled the Duquesne Light Company to carry war loads far beyond any in pre-war history without building additional transmission lines, except to connect new large industrial customers.

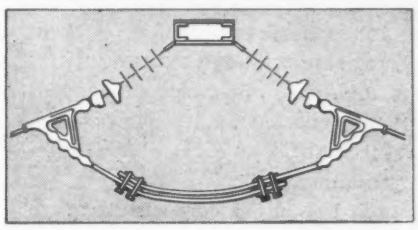


FIG. 2 — Two connectors on doubled loop of transmission

Splices and Connectors

In addition to the requirement that splices and connectors operate at temperatures no higher than the limits established by annealing of the hard-drawn copper conductor, it is necessary also that the contact surfaces remain always free from oxidation. The two fundamental methods by which oxidation may be prevented are (1) keep the temperature below the oxidizing point or (2) definitely exclude the source of oxygen.

Experience with switchgear has shown that oxidation troubles can be avoided by limiting the contact temperature to 70 C., and that contact troubles increase progressively as higher temperatures are permitted. The same temperature limit appears applicable to the copper alloy devices commonly employed to join copper conductors. Unlike annealing, which limits the effective temperature of the conductor but permits certain periods of higher temperature offset by equivalent periods of lower temperature, oxidation limits the highest temperature reached under least favorable weather and load conditions. With summer temperatures as high as 38 C. (100 F.), it is clear that only 32 deg. temperature rise can be permitted in the joints. A No. 4/0 bare stranded copper conductor limited to this temperature can carry only 340 amp. in still air.

Effect of Weather

Air movement tends to increase the current corresponding to those temperatures, while sun heating reduces the current. It becomes necessary, therefore, to analyze Weather Bureau data to ascertain which combination of atmospheric temperature, sun heating, and wind velocity should be used to determine the current limits. A sample of three winter months and six summer months has been analyzed hour by hour to determine the range of wind velocities for each degree of atmospheric temperature, plotted in Fig. 1a. It is important to note that the highest temperatures are coincident with appreciable wind velocities, indicating that some advantage may be gained over the current limits computed for still air. The most prevalent wind velocities lie well above the minimum values shown, the square-mean-root equivalent during a period of years and the corresponding equivalent effective atmospheric temperatures being at the points marked by small circles, which represent the values used to determine the thermal capabilities of the conductor.

Sunshine is believed to raise the temperature of a loaded conductor approximately 9 deg. F. (5 C.). The

* "Safe Ratings for Overhead Line Conductors", A.I.E.E. Technical Paper 43-85, Trans. A.I.E.E. 1943.

TABLE II
Preliminary Ampere Ratings for 4/0 Hard-Drawn Bare Copper Conductors

	Annual	Summer	Spring-Fall	Winter
Normal Operation	425	400	430	455
Emergency—1 hour switching time	605	560	605	665
Emergency—23 hours following switching	520	490	520	545

same data, with 9 deg. added to the atmospheric temperature recorded during periods of sunshine, are plotted in Figure 1b. As might be expected, the result is a general increase in effective temperature with little change in coincident wind velocities. The trend toward appreciable wind at the higher temperatures remains unchanged, however. The values used to determine conductor current capabilities again are indicated by small circles.

Conductor Temperatures

With the coincident values of atmospheric temperature, sun heating and wind velocity thus established, it becomes possible to plot the corresponding temperatures of the No. 4/0 bare stranded copper conductor carrying current up to the normal operating limit. The formula

$I = CD^{1.25}(T_2-T_1)^{0.5}(V)^{0.25}$ amp.

provides a convenient method, where

T_2 = conductor temperature, (C).

T_1 = effective atmospheric temperature corrected for sun heating, (C).

V = cross-wise component of wind velocity, taken as 40.5 percent of recorded mph.

D = conductor outside diameter, inches.

C = a constant, determined by substituting in the equation the value of current, I, determined by more accurate computations for the equivalent effective temperature corrected for sun heating, conductor temperature established by annealing and square-mean-root wind velocity.

The maximum and minimum values of conductor temperature at various effective atmospheric temperatures are plotted in Fig. 1c. These data indicate that the highest atmospheric temperatures are accompanied by sufficient wind to keep the conductor cooler than it is at lower atmospheric temperatures and minimum wind. The highest temperatures of conductors loaded to their normal current capabilities are 128 to 129 C. with one mile per hour of wind at an equivalent atmospheric temperature of 55 to 56 F. during winter months, and 109 to 117 C. with one mile per hour of wind at equivalent atmospheric temperatures of 63 to 76 F. during summer months.

These conductor temperatures are far higher than the 70 C. permitted on contact surfaces, indicating that the joints must provide sufficient heat dissipation to lower the temperature at points of contact or the conductor must be operated well below its current capability. The amount by which the temperature rise must be reduced is shown by Fig. 1d to be 51 percent.

Certain types of splices and connectors used on the Duquesne Light Co. system for No. 4/0 bare stranded copper conductor have been tested for contact temperature rise in still air at various current loadings. The tests were made with new connectors on tarnished conductor; oxidation of the exterior surface of the connector increases its ability to dissipate heat and tends to improve the current capability of the joint slightly. The results were listed in Table III, the last column of which lists the average decrease in temperature rise of the contact surface expressed as a percentage of the temperature rise of the tarnished conductor.

Test Samples

None of the test samples received special cleaning beyond that which is accomplished normally by a lineman with his knife. The value of even that partial cleaning is demonstrated, however, by comparison with corresponding data for double U-bolt connectors on uncleaned tarnished conductor. Special care in cleaning may not accomplish much reduction in temperature beyond that observed for the partial cleaning used in these tests, but should be considered insurance against occasional defective joints in which one or more strands may be required to carry a disproportionate share of the current, causing excessive heating and ultimate failure. It is recommended that the conductor surface be polished with sandpaper until bright, then smeared with an oxidation-inhibiting compound immediately before applying the connecting device. Whether similar cleaning is required for the connector depends upon the condition of its contact surfaces. Pressure should be applied immediately to squeeze the coating away from the points of contact. This procedure seems desirable regardless of which type of joint is involved.

No tests were run on the old-style served joints as experience has indicated that they are not dependable for heavy current operation. Several such joints of normal exterior appearance have been found defective internally. The served joint is fundamentally unsuited for splices in long-span conductors because thorough soldering to secure good electrical contact requires temperatures high enough to partially anneal hard-drawn

TABLE I—Seasonal Apportionment of Conductor Capability

	ANNUAL	SUMMER	SPRING-FALL	WINTER
Equivalent effect. Ambient temperature (C)	26.2	31.3	25.6	17.1
Square mean root wind, mph	10.5	9.1	10.6	11.8
Normal capability, 56% load factor, equivalent hours 20 years	98,000			
Equivalent effective, copper temp. (C)	59.0	63.0	59.0	52.5
Current capability, amp	535	505	540	570
Emergency—1 hour switching time, equivalent hours, 20 years	100			
Equivalent effective copper temp. (C)	100	100	100	100
Current capability, amp	760	705	760	835
Emergency—23 hours following switching equivalent hours, 20 years	2,300			
Equivalent effective, copper temp. (C)	77.5	81.0	77.5	72.5
Current capability, amp	650	615	650	685

copper and impair its mechanical strength.

These tests were conducted in still air. It appears probable, however, that moving air affects joint contact temperature by the same ratio as conductor temperature, as the formulas used to determine conductor current capability are applicable to a considerable range of conductor sizes, temperatures, and wind velocities. The most critical combination of atmospheric temperature, sunshine, and wind velocity for summer was shown by Fig. 1c to be 77 F. effective temperature at one mile per hour of wind; at 505 amp., this permits a temperature of 117 C. The double U-bolt connector, with 28.0 percent decrease in temperature rise, would have a contact temperature of 91.3 C. which exceeds the 70 deg. limit established to prevent oxidation. In order to stay within that limit, it is necessary to reduce the temperature rise of the conductor to 62.5 C., limiting the current capability of the No. 4/0 conductor joint to 415 amp. for a 17.8 percent loss of current capability. Similar values for the several types of joints are listed in Table IV.*

TABLE III—Temperature Rise of Splices and Connectors on No. 4/0 Conductor

	TEMPERATURE RISE IN STILL AIR, DEGREES C.					Average Decrease in Temp. Rise, Percent of Conductor Temp. Rise
	200 Amp.	300 Amp.	400 Amp.	500 Amp.	600 Amp.	
Tarnished No. 4/0 Conductor	13.1	25.5	43.9	66.0	94.7	....
Twisted sleeve splice on tarnished	7.5		29.0	41.6	56.8	38.8
Automatic splice on tarnished	9.9		37.8		75.0	19.8
Bronze parallel groove connection tarnished	8.6		30.5		56.6	35.0
Bronze double U-bolt connector on tarnished	10.1		35.4		64.5	28.0
Same, tarnished, not cleaned		25.7	42.9	63.2		1.9
Compression splice on tarnished			39.0	57.0	80.0	14.3
Same, tarnished, not cleaned			42.0	62.0	88.0	6.3
New bright conductor		28.3	49.0	75.2		
Bronze double U-bolt connector on new bright conductor		18.2	31.2	46.1		37.7

Emergency Conditions

Emergency operation involves heavier conductor currents for comparatively short periods of time. The most probable cause of the emergency is storm damage on other circuits and equipment. It seems reasonable to adopt a more liberal basis for establishing the current capability of joints for such conditions, either in the form of higher permissible contact temperatures or of greater minimum wind velocities. The former method has been used for station equipment where contact temperatures up to 90 C. are permitted for emergency operation; routine inspection includes the switch contacts, and any evidence of oxidation would be recognized and corrected. In the case of overhead conductors such inspection is not feasible; wind plays a greater part in dissipating heat, however, and it appears entirely logical to assume that the minimum wind velocity following such storms is at least one mile per hour more than the minimum used for determining normal current capabilities and to apply these modified wind velocities in conjunction with the 70 deg. limit. The temperatures reached by the No. 4/0 tarnished copper conductor carrying maximum 23-hour emergency currents are computed in the same manner as for normal currents, as plotted in Fig. 1c. Highest conductor temperatures are reached during winter 23-hour emergency loading of 685 amp, during infrequent periods of two miles per hour wind and 55 to 56 F. effective atmospheric temperature corrected for sun heating when the conductor may have a rise of 132 deg. C. to reach a temperature of 145 C. The contact temperature in a connector designed for 51 percent decrease in temperature rise would reach 78 C. The summer 23-hour emergency loading of 615 amp. causes somewhat lower conductor temperatures but the same connector would again reach a contact temperature of 78 C. It is evident, therefore, that this connector designed to carry safely the normal current capability would reach unsafe temperatures during periods of emergency loading. Present splices and connectors must be derated as shown in Table V.*

Although the emergency 1-hour switching time currents are appreciably higher than the emergency 23-hour capabilities, consideration of the thermal time constant and the slight probability of encountering such loading under least favorable weather conditions would seem to indicate that the de-rating factors of Table V may be applied with reasonable safety.

If greater current capabilities are required than the existing joints permit, then it appears practical to replace all splices and many of the connectors with compression splices. Such splices, if they are applied to the conductor under high pressure in such a manner as to prevent movement of air into the joint, should be free from impairment by oxidation and should function satisfactorily at any temperature which is permissible for the conductor itself. The remaining joints where connectors must be retained for operating reasons can be reinforced either by replacing them with connectors having proven ability to dissipate the heat, or by overlapping the ends of the conductor to provide parallel paths between two connectors spaced 4 ft. or more apart to reduce the amount of conductor heat to be dissipated by each connector. Such an arrangement, illustrated by Fig. 2, appears to be adequate for the full current capability of the conductor.

As indicated in the opening paragraph, however, magnetic heating of malleable iron suspension clamps also restricts the utilization of conductor current capability, and must be corrected before the full value of joint improvement can be realized. This part of the problem on auxiliary devices will be discussed in a subsequent issue.

* Tables IV and V will be presented with the ensuing installment.

Load Building by LAMP SALES

New England Gas & Electric Group Increases Average Wattage per Lamp Sold in Containers from 35 to 65.1—Employees Play Major Part in Developing This Business, Now Resumed on Post-War Basis Added Revenue Helped to Offset Loss of War Plant Load

W. G. KEAY, *Director of Electric Sales, NEGEA Service Corp., Cambridge, Mass.*

RESUMING full speed sales promotion activities, the operating utilities embraced in the New England Gas & Electric Association group again engaged in a vigorous campaign to fill empty domestic lamp sockets, replace burned out bulbs and establish higher levels of illumination in the home.

In 1927 the initial campaign with this load-building objective was started. Domestic cartons then sold contained four 40-watt and two 60-watt lamps, totaling 280 watts. The average wattage sold was 35. Year by year the campaign was repeated on the local properties until the war prevented continuance. The average wattage of lamps sold in the 1940 campaign was 60.3, the cartons containing two 100-watt, two 60-watt and two 40-watt lamps, or 400 watts per carton.

First Post-War Campaigns

In the first post-war campaign, which ran from October 1 to October 31, 1945, two 40-watt, four 60-watt and two 100-watt bulbs, of 520 watts total, were sold in bags at the modest price of 97 cents, tax included, payable on the customer's next monthly service bill. The average wattage per lamp was 65.1, a healthy increase over the previous peace-time campaign.

These lamp carton campaigns have been cumulative in their results, their success depending on consistent and steady efforts each year to increase the average wattage per bulb in the carton or bag sold so as to insure better lighting. Their annual recurrence has been a helpful factor. Employees all up and down the line participate and the public feels the reiteration of the sales appeal and opportunity each fall when the shortening days emphasize the importance of Better Light-Better Sight objectives.

Planning Campaigns

The first step in setting up the campaign is the preparation of a prospectus outlining the current activity, which is sent to all general managers and sales managers of the operating properties. This is always an attractive folder containing a message from the president of the Association or one of his chief assistants, with a few words from the director of electric sales, information on the contents of the carton or bag for the current campaign, the price, period of activity, quotas established (these are made only to be broken by the largest percent possible), property prizes and general prizes. Contests between properties are set up to stimulate further interest. The great value of national advertising is noted and schedules of local advertising suggested. Store and window displays are suggested. Among the rewards for high men in sales is a football game and dinner sponsored by the president.

After the issuing of the prospectus and before the opening of the campaign, the director of electric sales conducts a series of employees' meetings on the local properties. The policy is to limit these in general to the personnel of one department at a time, in order better to get the sales message across and insure free discussion with smaller and more intimate groups. In these meetings charts and other data are presented emphasizing market opportunities. Thus, last fall it was shown that on the New England Gas & Electric system, by applying national survey indices, a potential market of about 500,000 empty sockets existed on these properties in advance of the first post-war campaign. It was also emphasized that the customer, the employee and the company all benefit from this activity. Additional revenues derived from lamp sales count toward offsetting losses due to the curtailment of war plant loads since the end of hostilities.

Report Progress

Once the campaign is in progress no further meetings are scheduled, but the director of sales keeps in personal touch with all local companies throughout the duration of the activity. Reports are sent into headquarters at Cambridge, Mass., and

Need Light Bulbs? ORDER NOW!
FILL EMPTY SOCKETS
A handy bag of assorted sizes for the home. Use proper size bulbs in your lighting fixtures for the best results.
Please bill me on my next month's service bill for _____ Sight Saving Packages at 97¢ each (tax included).
Name
Street
City or Town
Sale by
S. S.
SIGHT SAVING BAG
Consists of 2-40 / 4-60 / 2-100 Watt Bulbs
Eyesight...Your Most Precious Gift Guard It!

POST-CARD order enclosed with monthly bill

bulletins of the progress of the campaign are sent weekly to the properties.

Commissions and Prizes

A commission of 15 cents per bag of eight bulbs is paid to every employee making such a sale, provided the sale totals 520 watts or more per bag. Prizes are established in the discretion of the local utility managements, but in general it is suggested that a sum of 3 cents per bag be set aside to be awarded as prize money. In the 1945 campaign at least 65 percent of the employees of the local properties participated actively in lamp bag sales. The sales in bags totaled 190,656 lamps aggregating 12,400 kw. On the system 22,088 bags of 520 watts combined lamp rating and 2,372 bags of lamps below this total, or 4,460 bags in total were sold, exceeding the quota of 17,650 bags by 38 percent. More bulbs were sold than in any previous activity and the average wattage per bulb exceeded all previous records. The total number of domestic customers on the system, not including seasonal customers, was 107,754, and the number of lamps sold (in bags) during the 1945 campaign was 1.76 per meter.

All lamps are sold at list price, and the gradual increase in the wattage of cartons or bags has won public acceptance throughout the system.

The estimated revenue from energy sales for the 1945 quota of 17,650 bags of lamps averaging 65 watts per bulb was $26,177 for the eight utilities comprising the system. Profits from the sale of the cartons of bags themselves are small and if an even break is obtained here it is regarded as satisfactory. The campaigns are aided by the national advertising of manufacturers in the press and over the air, and local advertising by the utilities concerned published weekly during the campaign as well as order cards inclosed with bills contribute their part.

It's Worth Trying

There seems to be no reason why any utility cannot put on campaigns of this kind with success. The value of the load obtained and revenue applying to added lighting are worth considering. Careful planning, common sense and a spirit of friendly understanding and helpfulness to the employees who are the backbone of these sales activities are fundamentally important.

New England Gas & Electric Association
1945 Bagful of Lamps Campaign

COMPANY	NO. OF LAMPS	AVERAGE WATTAGE LAMP	DOMESTIC CUSTOMERS*	LAMPS PER METER
Cape & Vineyard	19,280	66.4	10,708	1.80
Plymouth	8,912	63.9	9,842	0.90
New Hampshire Group	16,456	65.6	10,714	1.53
New Bedford	76,944	63.9	40,854	1.88
Cambridge	60,504	64.9	30,024	2.01
Provincetown	2,552	64.3	1,522	1.67
Derry	6,008	65.4	4,090	1.45
Total	190,656	65.1	107,754	1.76

*Does not include seasonal customers.

THOROUGH GROUNDING
Pays Dividends in Service

R. C. STEVENSON, JR., *Electric Power Board of Chattanooga*

Nine out of ten grounds found insufficiently conductive —Improvement in grounding results in cutting to one-third the distribution transformer interruptions—Customer calls drop, customer satisfaction rises

IN A TYPICAL AREA on the Chattanooga system where 430 grounds were investigated, the average resistance of all grounds before improvement was 220 ohms. The average resistance after improvement was 20 ohms. In plain arithmetic, this means that with 100-amp. ground current flowing during a fault the reduction in ground resistance would reduce the rise in ground potential approximately 20,000 volts. This is the voltage to which persons contacting the line and equipment connected to it could be subjected under certain conditions.

Some few years ago a lineman was severely shocked and burned when he opened an air break switch on a 12-kv. line preparatory to a clearance. Investigation disclosed that opening the switch had cracked an insulator which flashed over to the frame. The operating handle for the switch was grounded but the resistance of the ground connection was so high that part of the charge passed through the lineman's body. Just a few months later there occurred a very similar case except that it was in a substation where the switch handle was well grounded and the operator did not even feel a shock. Ground connections were immediately investigated and improved, where necessary, on all 44-kv. and 12-kv. air break switches on our system.

GROUND ROD is driven under the surface to make opening through which wire can be pulled preparatory to connecting three ground rods together. Minimizes trenching of lawns

Grounding Really Protects

The purpose of grounding is, therefore, to protect customers and employees against personal injury and to protect property and equipment on the customers' premises as well as on the utility lines. By so doing the operation of the system will be improved and consequently better service to customers will be provided.

The Chattanooga distribution system is divided into 25 areas and the grounding has been improved in nine of these areas. A three-year operating record on two areas covers a total of approximately 350 distribution transformers. For one area, the records show the number of distribution transformer interruptions due to lightning was 3.4, 1.6, and 1.4 per one-hundred transformers in 1943, 1944, and 1945, respectively. The other areas show 11.3, 10, and 4 for the same period.

After each lightning storm there are usually anywhere from six to twelve investigations to make because lightning has caused some damage to customers' equipment or premises. In three years but two such calls have been received from areas where grounding has been improved in spite of the fact that the majority of calls came from these areas before the grounds were improved.

Grounding Pays a Return

During the past three years, 2,727 grounds have been investigated on our system. Of this number it was necessary to make some improvement to about 90 percent, or 2,450 grounds. The total cost of our ground improvement program including labor, material, transportation, engineering and overhead up to July 1, 1946, was $29,435.50. This gives an average cost of $10.80 per ground investigated or $12.00 per ground improved.

One intangible benefit that results from improving grounds is the fact that the grounding crew is continually locating defective insulators, lightning arresters, cut-outs, etc., all of which are potential cases of trouble. Such trouble is repaired immediately

and in this way many service interruptions are avoided.

A second ground crew has recently been added because after three years' experience, we are fully convinced that proper grounding is even more important than had been thought in the beginning. Those in our organization who are responsible for engineering, operation, and maintenance are of one accord on our grounding program, that is, that it is not only worthwhile but is paying good dividends every day.

Depth Is Advantageous

Prior to 1945, we used only standard 8-ft. ground rods but experiments proved that deep grounding was a very effective method of reducing the resistance. In and around Chattanooga the terrain varies from river bottom to mountain top and there are many locations where it is difficult to drive even an 8-ft. rod. However, there are other locations where we have been able to drive rods as much as 34 ft. into the ground. The effectiveness of deep grounding is shown by the tabulated results of a typical test.

For deep grounding an 8-ft. threaded rod and couplings are used so that any number of rods can be coupled together. A special driving cap is used to avoid damaging the threads. Rechecking the resistance of deep grounding installations has proven that their resistance will decrease as much as 40 percent after the soil has settled firmly around the rod. This is due to the coupling being larger than the rod, which makes the hole in the ground larger and results in poorer contact between the rod and the earth until the soil has settled firmly around the entire rod. Our experience with deep grounding has led us to adopt a practice of using this method where it is possible to do so.

Procedure Is Methodical

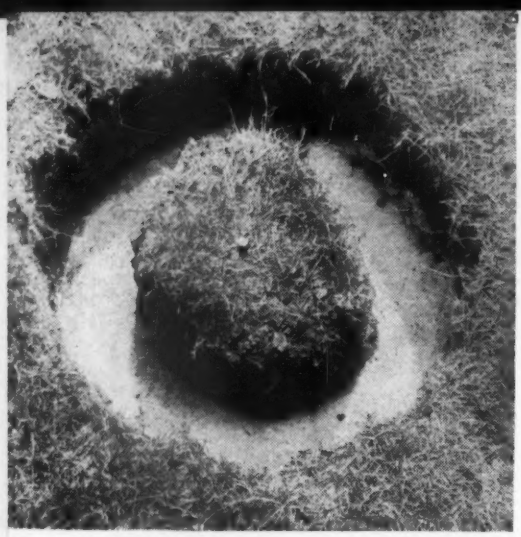
Grounding is affected by so many factors that it is impossible to treat all grounds alike and expect anything near consistent or similar results. The type of soil probably contributed more to variations in ground resistance than any other single factor. We have adopted a more or less standard procedure for improving grounds and the prevailing conditions will determine which step in the procedure will be tried first. This procedure can be described best by taking a specific case. Let us suppose that the resistance of the ground using a standard 8-ft. rod measures 200 ohms. If a water pipe is available and is not more than 60 ft. away, the ground rod is connected to it. This usually reduces the resistance to 5 ohms or less which, of course, is entirely satisfactory. If there is no water system available at this location, the first step will be to drive an 8-ft. section of an extension ground rod not less than 6 ft. from the existing ground and measure the resistance of the two rods tied together. Only in rare cases does this alone reduce the resistance to less than the 25 ohms which is considered the maximum allowable.

If the resistance is not reduced sufficiently, sections are then coupled to the extension rod and a reading taken after each section has been driven. This procedure is continued until the resistance is reduced sufficiently or until the rod cannot be driven any deeper. If the resistance is still too high and the rod cannot be driven any deeper, another 8-ft. section of extension rod is driven at a new location and connected to the two existing rods. The new rod is then extended and driven a section at a time until the resistance is reduced sufficiently or until the rod cannot be driven any deeper.

THREE driven rods have been interconnected and the earth resistance of the group is being measured. Rods are not less than 6 ft. apart

Salt Is Last Resort

If the resistance is still too high the last step is to salt the ground. The number of ground rods is limited to three because tests have shown that the second rod reduces the combined resistance about 40 percent, the third rod about 20 percent, and the fourth rod only about 7 percent. On this basis the fourth rod cannot be justified. Reverting to the special case, let us assume that two additional deep



CIRCULAR TRENCH has been dug for the salt so that ground rod is left in center of island of earth about 18 in. in diameter and 2 ft. deep

rods have been driven as deeply as possible and tied in with the existing rods, but the resistance measures 30 ohms. This would be left as is because the resistance of deep rod grounds can be expected to decrease as much as 40 percent after the soil has settled firmly around the rod. But if we assume that under this condition the resistance measures 100 ohms instead of 30 ohms, the next step would be to salt two of the grounds. Since salting has no immediate effect, we arbitrarily say if the resistance is 50 ohms or less, one rod will be salted, for 51 to 100 ohms two rods will be salted, and over 100 ohms all three rods will be salted. It is our practice to salt the highest resistance rod first, the second highest next and so on.

The procedure for salting a rod is to dig a trench around it on a radius of about 9 in., which leaves the rod in a core of earth about 18 in. in diameter. This trench is about 2 ft. deep and in it is buried approximately 50 pounds of salt. It is indicated from our experience that the behavior of a ground after being salted is very inconsistent, but we do know definitely that six months after grounds have been salted their resistance will be something in the order of 20 to 50 percent of their resistance before they were salted. We have concluded that it is not practical to salt grounds in a loose, gravelly soil.

Relative Merits

Listing the methods of reducing ground resistance in the order of their effectiveness: No. 1 would be the water pipe, No. 2 the deep rod and No. 3 salting. In fact, we have concluded that salting should be employed only as a last resort, because while we haven't been able to determine how long it will last in some types of soil, we do know that in other types of soil it provides only a temporary solution. Incidentally, during the past three years we have used about 75 tons or 150,000 pounds of salt.

Lightning arrester ground and the secondary ground are interconnected

TABLE I

Resistance Less for Deep Rods

Rod Depth in Feet	Resistance in Ohms	Rod Depth in Feet	Resistance in Ohms
8	225	22	28
12	160	24	20
14	91	28	11
16	81	30	8.5
20	47	32	7

provided requirements for interconnection can be met. The interconnecting is done by a line crew after a grounding crew has finished an area. In some instances, a water pipe will not be available at the transformer pole but will be available to the secondary neutral several spans away. In such a case the lightning arrester ground would be improved as much as possible but the secondary neutral would be connected to the water pipes to provide a satisfactory ground on each side of the transformer. In regard to interconnection this case would then assume the same status as any other.

Trenches Minimized

Before our program of grounding improvement began, more than three years ago, secondary and lightning arrester grounding, where water pipes were not available, was simply a case of driving a rod and connecting the ground wire to it. Also the original method of tying two or more ground rods together, or tying a ground rod to a water pipe, was to dig a trench in which the tie wire was buried, but a new method was developed. It consists of digging a hole around each ground rod, leaving the top of the rod about 9 in. below the original surface, and then driving a rod between holes under the surface, making an opening through which the tie wire could be pulled. This method saves much time over the trench method, besides making a more satisfactory job from an appearance standpoint.

As to improvements that have been made in equipment since the program began, we started out using a magneto type ground Megger to measure the resistance. We soon found that this instrument was affected by stray ground currents and in some cases it was impossible to get any reading at all. For the past two years, we have used a battery type ground tester which has proven very satisfactory in operation.

TABLE II—Results of Tests of 1,600 Grounds

THE INFORMATION tabulated is from seven of the substation areas in which ground improvement has been completed. The comparatively small number of grounds that were improved by deep rods only is due to this type of improvement having been practiced on this system only during the past year. Similar future tabulations will show a larger percentage of improvements by the deep rod method.

The comparatively large number of grounds reported still above 25 ohms is due to the salt not having become effective when the resistance was measured. Rechecks indicate that practically all of these grounds measure less than 25 ohms after the salt has become effective.

	LIGHTNING ARRESTER GROUNDS	SECONDARY NEUTRAL GROUNDS
Number of existing grounds investigated	621	984
Number of water pipe grounds installed	134	306
Number of grounds found of less than 25 ohms	104	168
Number of grounds found of 25 to 50 ohms	51	86
" " " " " 51 to 100 ohms	93	142
" " " " " over 100 ohms	373	588
Number of additional ground rods installed	501	819
Number of grounds improved by adding ground rods only	80	118
Number of grounds improved by salting rods	274	358
Number of grounds improved by deep ground rods in addition to regular rods	25	25
Number of grounds improved by deep rod only	16	19
Average resistance of all grounds before improvement, ohms	173.6	177.6
Average resistance of all grounds after improvement, ohms	19.8	14.0
Number of grounds still above 25 ohms	129	153

Analysis of SPA Report Criticized

FOLLOWING publication March 30, 1946, of the article, "SPA Hydro Program—Summary and Fallacies," ELECTRICAL WORLD *received letters from the author of the report on which the article was based, William J. Fell, of Cochrane, Hendrix, Fell & Wheeler, consulting engineers, Tulsa, Okla., and from Douglas G. Wright, Administrator of the Southwestern Power Administration. The letters are closely parallel and for convenience of the reader are combined by paragraphs in the following presentation of them. They are printed in the spirit of fairness to which Mr. Wright appeals in his concluding paragraph.*

The only comment offered on these two letters is that the conclusions in the article appear justified if the data on which they were based are reliable. All figures used in the article had no other source than the SPA report. Furthermore, the article mentions none of the political considerations figuring so largely in the letters, but is concerned only with engineering matters.

Mr. Fell: "The editorial article beginning on page 60 of your issue of March 30, 1946, contains so many erroneous and misleading statements that it exemplifies the "other kind of engineering" to which you sarcastically refer. This article purports to review and criticize the Report on the Comprehensive Plan of the Southwestern Power Administration, in the preparation of which the writer had some part."

Mr. Wright: "I have before me the March 30 issue of ELECTRICAL WORLD in which, on page 60, there is an article entitled "SPA Hydro Program—Summary and Fallacies" attacking the appropriation request of the Southwestern Power Administration which is now pending before the Congress.

"The ELECTRICAL WORLD article is misleading and inaccurate and its conclusions are not sound. Even though your publication has always bitterly fought the generation and transmission of electric power by the federal government, it generally reports engineering facts. In this instance your article not only does not conform to the facts, but you attack with unsound conclusions the careful studies of engineers who have been long identified with the generation and transmission of power.

"In the development and conservation of our water resources various benefits can be secured such as flood control, navigation, irrigation, and generation of electric power as the case may be. In building these multiple purpose projects it would be an economic waste of natural resources if power were not developed wherever it is feasible to do so. The Congress has directed that this power shall be produced and made available in wholesale quantities, with preference to public bodies and farmers' cooperatives, in such manner as to encourage its most widespread use at the lowest possible rates to consumers consistent with sound business principles. The objective of the report of the Southwestern Power Administration is to dispose of this federally generated power in the manner laid down by the Congress. This federal public power policy has been reiterated time and time again by the Congress in such power acts as the TVA, Bonneville, Fort Peck, and others. The ELECTRICAL WORLD article ignores completely this Congressional directive as to the manner of disposing of power generated at these federally constructed projects. Indeed, your article is directed more particularly against the policy of the Congress upon which the Southwestern Power Administration's report is based than upon the soundness of the report itself."

Mr. Fell: "Disregarding baseless general criticisms appearing in your story, it is possible to express your principal contentions briefly as follows: (1) The federal government could produce the same power and energy at less cost by steam alone; (2) The investment in an all-steam system would be less; (3) The privately owned electric companies cannot afford to pay the rates for peaking power set out in the report; (4) There is no dependable capacity at the proposed hydro plants and the entire output will be dump energy; (5) The construction costs of some elements of the system have been estimated too low, and cost of such construction will rise markedly during the 20-year period. A discussion of these points follows.

"In attempting to show that the government would be better off to construct an all-steam system to produce the same power, you have prepared a table headed '20-Year Operation.' In this table you have used the figure of 4.86 mills per kw.-hr. for energy delivered to the load, derived from Table VI on the same page. Table VI, which is a condensation of Table 20 of the Report on the Comprehensive Plan, fails to show what elements of cost are included. It is not apparent to the casual reader that transmission costs are included in the fourth column of your Table VI, although reference to Table 20 of the Report makes this clear at once. You have then proceeded to compare this figure of 4.86 mills, which includes transmission costs, with the cost of steam energy production (adjusted for losses) derived in your computation, which does not include transmission costs. This comparison is neither adequate nor fair.

"Whether it be assumed that the government should own transmission lines to wholesale users, or whether it be argued that the private companies should own them, a proper transmission charge must be included in order to make a comparison of costs at the load. The all-steam system should be credited at the most with elimination of that part of the high-tension system which is necessary in order to reach the isolated dam projects. The mere presumption of different ownership does not justify the omission of transmission

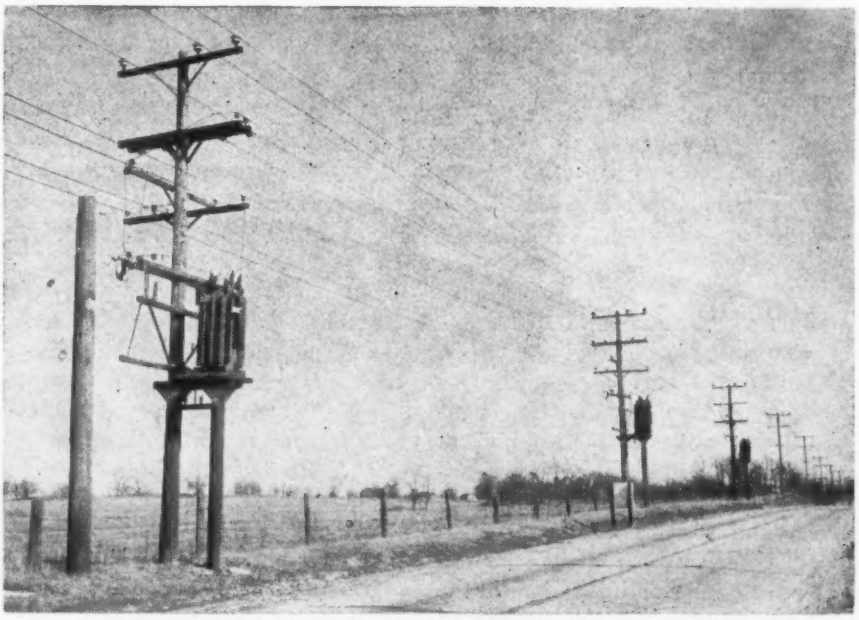
(Continued on page 86)

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Transformer Bank Mounted on Line Poles

R. H. MacKINNON
Public Service Co.
of Northern Illinois
Northbrook, Ill.



AMPLE CLEARANCES and reduction of traffic hazards are provided by this installation of a three-phase bank on three line poles

WHERE elimination of special racks or platform structures for transformer installations may be desirable, two or three single-phase installations on adjacent line pole structures will offer some advantages. This is particularly desirable for step-down transformer banks 7,200 /12,470 volts wye to 2,400/4,160 volts. Such an installation for three single transformers of a three-phase bank, as designed by Public Service Co. of Northern Illinois, is shown in the accompanying illustration.

In this case, the weight of each transformer exceeded 2,200 lb. and a stub-pole in front of the line pole was used. This arrangement provides ample clearance from the 7,200-volt conductors and equipment.

Advantages of this design are: transformers may be replaced without difficulty; original and maintenance costs are reduced; dispersal of the three-phase installation reduces service hazards due to traffic accidents along the highway; standard line construction material only is used.

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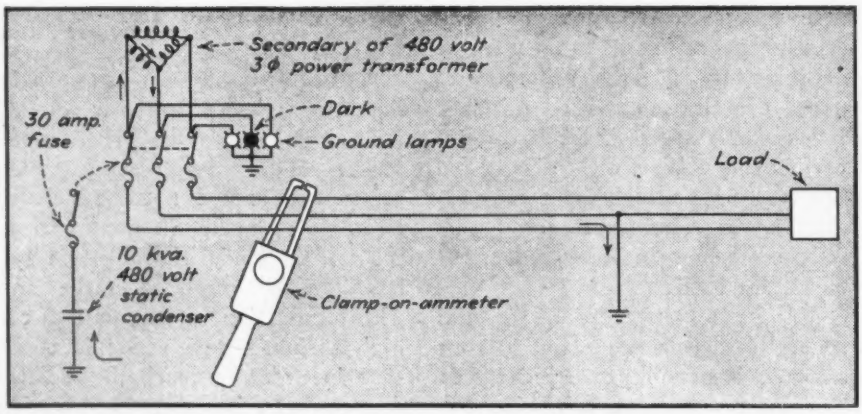
Clamp-On Ammeter Finds Grounds on Loaded Circuits



LOW-RESISTANCE GROUNDS on energized three-phase circuits are found by using a clamp-on ammeter to trace unbalanced current circulated by phase-to-ground load. Circuits in conduit are tested at junction boxes

STEPHEN B. HOAG
Engineer for Lyle E. Patton
Consulting Electrical Engineer
San Francisco, Calif.

GROUNDS on three-phase, low-voltage power circuits may easily be located with a circuit energized, and even carrying full load, by use of a clamp-on ammeter as shown in the accompanying diagram and as herein described. The method is based on the fact that the algebraic sum of the currents in any balanced three-phase circuit is zero at any given instant, and if a current is then caused to cir-

culate through a grounded conductor, a clamp-on ammeter placed around all three conductors will read the unbalanced current. By testing at various points along the circuit a fault can easily be located. If the circuit is in conduit, access for test can be had at junction or pull boxes.

The diagram shows a 10-kva. static condenser as load-to-ground to cause a current to circulate through the fault, although any load of several kilowatts will do as well. Quite obviously, faults to be located by this method must be metallic grounds or of low enough resistance to permit an appreciable circulating current to flow.

• • •

Interrupter Aids Fault Location

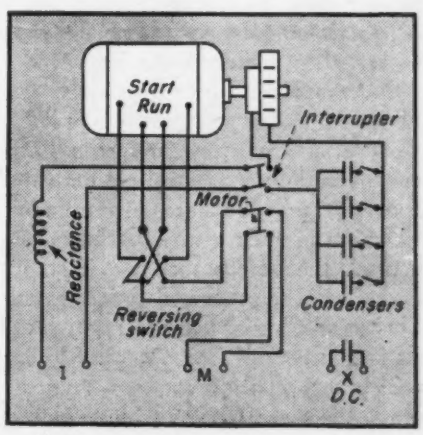
FURTHER PARTICULARS have been made available through the Boston Edison Co. in relation to an interrupter used in applying tracer current to ungrounded 3-phase distribution secondaries (ELECTRICAL WORLD, December 23, 1944, page 62). The interrupter consists of a 20-segment commutator mounted on the shaft of a 1/6-hp., 60-cycle, 1,750-rpm. induction motor. Two brushes contact the commutator. The slip of the motor governs the amplitude wave which gives the signal its characteristic beat. The end of the commutator is fitted with an insulated brass disc with 20 screw holes through which contacting screws threaded into the commutator bars may be used to connect segments together as desired. By using various combinations of screws in various positions the character of the signal sent out over the line can be changed. Usually four segments 90 deg. apart are connected, producing two current impulses per revolution through the brushes.

Circuit Detail

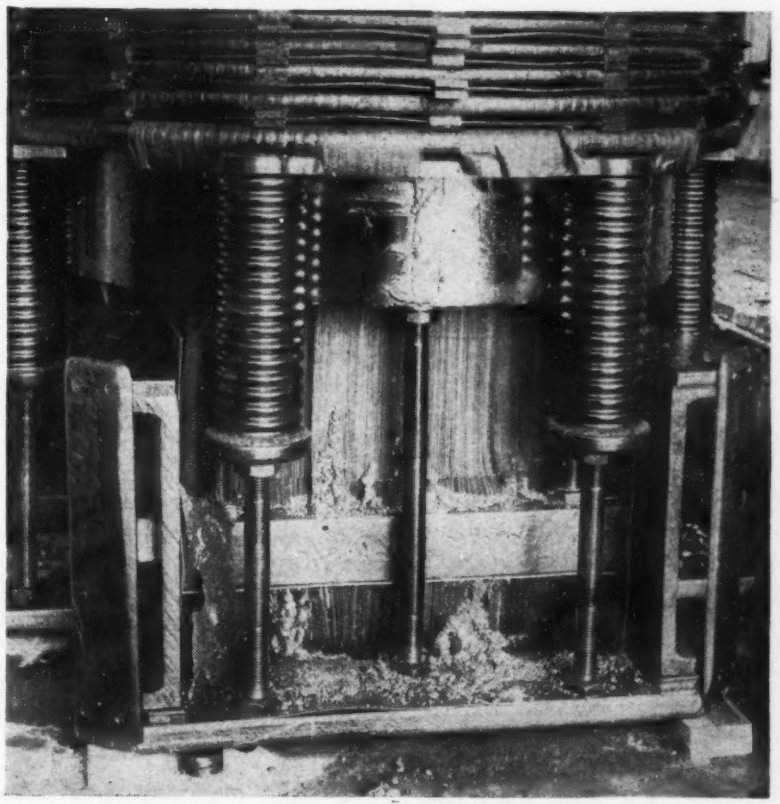
The reactance shown in the drawing consists of No. 18 wire wound on an iron wire core 8 in. in diameter with 0.75-sq.in. cross-section. It has an inductance of about 7 millihenries. The four condensers shown are of 5 microfarads each, rated for about 1 kv., d.c. operation. The voltage waves in this interrupter circuit include most of the odd frequencies in about equal percentages up to 1,500 cycles. Increasing the number of condensers in the circuit by means of the four switches increases the resonant frequency and adds lower tones of greater carrying capacity.

The exploring coil to be used with this equipment should be wound lengthwise on rectangular laminations

ARRANGEMENT of interrupter which superimposes tracer current on circuit under test



Laminations Reoxidized for Cannibalized Core



IRON PELLETS, bulging of laminations and burning at core bolt holes were visual evidence of excessive heating of cores that failed in two 30-year-old, 10,000-kva., 95/12-kv., three-phase transformers on system of Pacific Gas & Electric Co. One good core from the two was made in San Francisco service shop of General Electric Co. Problem of reoxidizing laminations was solved by placing sheets in asbestos lined boxes and loading with layer of charcoal. Thin asbestos sheets were used every inch in restacking laminations to minimize chances of eddy currents

(2.5 x 5 in.), totaling $\frac{3}{8}$ in. in thickness, and which have been arched in the short direction to fit the sheath of the largest cables. The winding should be matched in impedance with the earphones reasonably well at about 1,000 cycles. A rubber-covered duplex lead 36 in. long provides a convenient connection between coil and earphones. Black insulating varnish over cotton tape provides a good finish for the coil.

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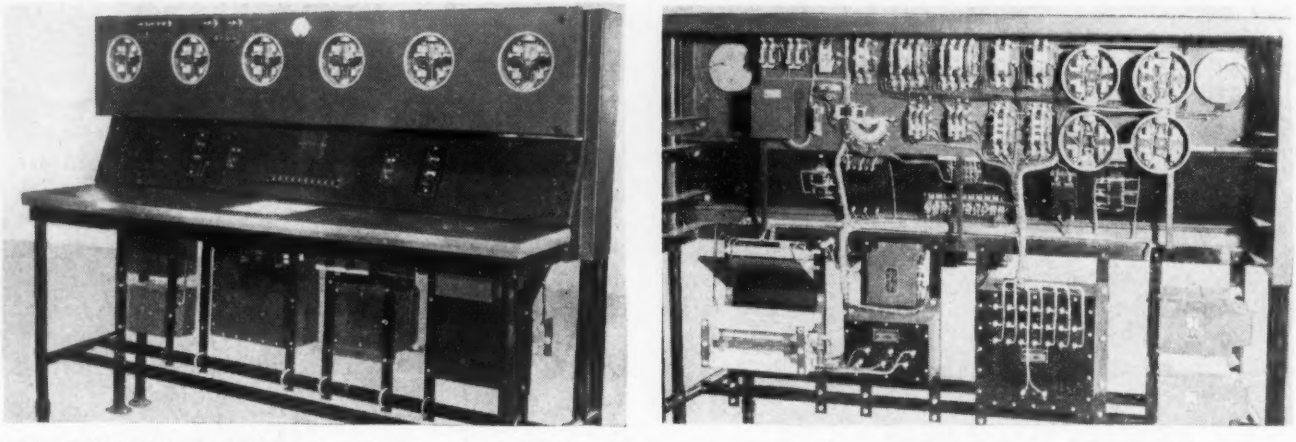
Gang Board Speeds Tests of Socket Meters



SIX SOCKETS are provided in this gang test board for socket type meters. Front and rear views of the panel are shown

To EXPEDITE shop test of socket type meters brought in for periodic check and cleaning, a gang type test bench has been designed by F. E. Davis, Commonwealth & Southern Corp., Jackson, Mich. Three boards were built and are now in service. Arrangements are made for accuracy tests at light load, heavy load, and lagging power factor with comparison to the standard laboratory meter.

With the gang board, six meters are inserted at a time. One tester can test 28 to 42 meters a day as against 12 to 16 with the single meter board.

• • •

Taking Safety to Remote System Points

To INSURE better coverage of safety practices at all points on its system, an eastern power company has adopted a plan under which group meetings are held at intervals for employees located at scattered generating and substations where the number of men at each plant is too small to warrant separate sections of the accident prevention set-up. All such employees are invited to attend a safety meeting nearest their station, and are paid on an overtime basis for such attendance. Travel expenses, when required, are approved by the company's safety director.

Where a hydro plant cannot be left in operation for a few hours on the basis of automatic control equipment service, it may be necessary to adjust shifts in such a way that attendance at the safety meeting in the general area selected will proceed on a rotation basis. The relatively small number of men required to operate or inspect modern hydro plants of even 10,000- to 30,000-kw. rating or more, especially where automatic control functions regularly, enables attendance at local safety meetings to be representative and valuable.

On this system there is a trend toward standardization of safety methods and their distribution throughout the property which is informative and timely. Considerable attention has been lately given to follow-up work from headquarters. Emphasis has been laid upon the importance of every division manager and department head accepting increased responsibility for safety work and arranging for line foremen to have some free time for special safety consideration.

Like many other systems, there has been so much pressure under war conditions to maintain service that standardized routines have had to be postponed to some extent; but now interest in these is expanding. Illustrated talks on safety are coming into wider use at even small group meetings, and the free discussion of safety is encouraged among those in attendance.

In the field the company is stressing the importance of checking safety practices and principles rather than "cracking down" on individuals, and in reporting unsafe conditions or lapses identification of participants is not revealed. Company papers reach the most remote points and employees on the system, and news of good safety records stimulates men far from headquarters to live up to such obligations. In this connection efforts are being made to improve reports of accidents from all sections of the system, giving as full data as possible. Comments by division managers on accidents are not inscribed on accident report forms but are made in separate letters or memoranda to headquarters. These steps are aiding company officials in determining the extent of the utility's responsibility for accidents, besides giving the safety organization better material to analyze and interpret for the benefit of future operations.

How to Use Welding Equipment to Thaw Frozen Water Pipes

R. F. WYER

Electric Welding Division, General Electric Co., Schenectady, N. Y.

Data and operating instructions are applicable for both a.c. and d.c. arc welders.

FOR A THAWING OPERATION no special equipment is necessary other than reliable pipe clamps for making firm electrical connections. Strap-type clamps of copper, having ample section to carry several hundred amperes, are desirable. C-clamps may be used to clamp cable terminals directly to the pipe where necessary. A file, rasp, or abrasive cloth may be used to remove zinc oxide, rust, paint, and grease to assure a good electrical contact.

Cable should never be wrapped around the pipe as a connection, since it is practically certain to loosen, and may cause hazardous sparking. Ordinary pipe wrenches are required for disconnecting piping. A portable voltmeter is useful for checking voltage drops and continuity of circuits.

Cable connections to the welding generator are made in the ordinary way. The work lead and electrode lead are connected to the pipe on opposite ends of the frozen section. For economy, it is desirable to get as close to the frozen portion as is feasible without excessive digging in frozen ground. At the beginning of a thawing interval it is desirable to set the machine at the lowest current output adjustment in order to permit checking connections with the least likelihood of flashing.

Thawing Current

While the proper current for thawing customarily encountered pipes usually falls between 200 and 500 amp., the time needed to complete the job varies greatly according to the size, length, kind, and location of the pipe, condition of the surrounding soil, extent of the freeze, and temperature of the air. Tables 1 and 2 will help determine the various factors involved.

While the resistances tabulated are for direct current, the reactance is so small that it can ordinarily be neglected when cables are not coiled. There are so many other variables in a given case that the voltage necessary to produce the current will be, for all practical purposes, the same for both alternating and direct current. Table 3 lists the maximum outputs which can be obtained from the arc welding equipment, and which would normally be used for pipe thawing.

Where welding sets are to be operated at less than 80 percent of their ampere rating, the operation can be continuous. That is, a 400-amp. d.c. set can be operated continuously at 320 amp. without damage. Likewise, a 500-amp. transformer can be operated at 400 amp. continuous. The sets may be operated at their maximum output for intermittent periods up to 15 min. if sufficient time is allowed for return to normal temperature.

Precautions

When using arc welding equipment for thawing purposes, there are a number of precautions which must be observed. A good, low-resistance joint is to be obtained between the copper cable and water pipe, otherwise excessive heat will be generated at the connection. If the current is allowed to form an arc at this point, it may damage the pipe.

Care should be taken to select the correct amount of current where there is known to be lead in the service pipe, because lead pipes will stand less current than iron. The pipes should be disconnected from the building piping before the wiring connections so that the current has only one path in which to travel—through the section which is frozen. If this is not done, where other devices are grounded to the water pipes the ground wires may burn out and cause a fire, since the grounding connections will be raised above earth potential.

In using single-operator d.c. sets, two points should be noted. The low load voltage will result in the possibility of unusually heavy currents on the lower taps. Since these taps are designed to carry the low currents which will be drawn at normal operating voltages, the result may be to overheat portions of the series field. This can be avoided by setting the units on the highest tap and lowest open-circuit voltages which will give the desired current.

In addition, the low load voltage should be considered in making an estimate of the current setting required. Since load voltages in the neighborhood of 5 or 6 volts will often be encountered, the output current on any setting will be as much as 1½ times the current which would be drawn by a welding arc. With transformers, however, the current drawn by the load will be very nearly that indicated on the nameplate.

As a final precaution, the resistance of the joints in the pipe should be determined. If the joints are insulated by rust or pipe dope, a spark may start a fire.

TABLE I—Thawing Current and Time

PIPE DIAMETER, IN.	RECOMMENDED AMPERES	APPROX. MINUTES TO THAW	RECOMMENDED CABLE SIZE	RESISTANCE PER 100 FT. CABLE
1/4	75	15	No. 6	0.0395
1/2	125	20	No. 2	0.0156
3/4	200	20	No 1/0	0.00984
1	250	30	No. 2/0	0.00780
1 1/2	300	30	No 3/0	0.00619
2	350	40	No. 4/0	0.00491
4	600	75	400,000 cm	0.00270
6	800	120	600,000 cm	0.00180

TABLE II—Resistance of Standard Pipes Ohm per 100 Ft.

PIPE DIAM., IN.	WROUGHT IRON	STEEL	COPPER TUBING	LEAD	CAST IRON CLASS A
1/2	0.026	0.0198	0.00824	0.0234	
3/4	0.0202	0.01485	0.00445	0.01371	
1	0.0138	0.0100	0.0034	0.00984	
1 1/2	0.00842	0.00618	0.00208	0.0064	
2	0.00625	0.0046	0.00133	0.0053	
4	.....	.....	.....	.....	0.0092
6	.....	.....	.....	.....	0.006

TABLE III—Maximum Arc Welder Output Intermittent Thawing Current in Amperes

EQUIPMENT	10 Volts	20 Volts	30 Volts	40 Volts
300-amp. a.c. welders.....	500	450	400	375
500-amp. a.c. welders.....	800	750	700	625
300-amp. d.c. welders.....	650	600	500	400
400-amp. d.c. welders.....	800	750	700	600
600-amp. d.c. welders.....	1200	1000	900	700

Specify "THYRITE"

For Unexcelled Protection of

Thyrite* arresters limit lightning voltages or switching surges to known levels for co-ordinated protection —predetermined over the range of impulse wave fronts and discharge currents expected in service. The efficient valve-action of Thyrite arresters prevents short circuits, outages, or other system disturbances while discharging moderate or severe lightning currents of either single or multiple strokes.

Pyranol protective capacitor and THYRITE station type arresters, 3-15 kv ratings, for protection of a-c rotating machines.

Thyrite STATION-TYPE Arresters for ROTATING MACHINE Protection (3 to 15 kv Ratings) Provide:

An exclusive G-E design, for indoor or outdoor service, which has porcelain top and center line terminal and gives adequate line-to-line clearances, even when single-pole arresters are installed *directly adjacent to each other.* This greatly conserves installation space, essential to location of arresters in pits under rotating machines, in bus compartments, or cubicles, and in metal-enclosed switchgear, etc.

Valve and gap elements of these arresters are similar to those in Thyrite station-type arresters of equivalent ratings in the interchangeable unit construction.

* *Reg. U. S. Pat. Off.*

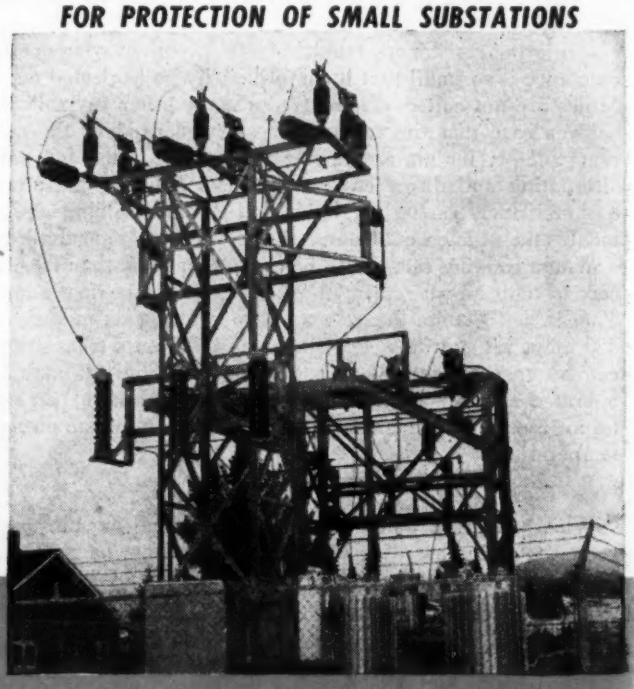
Thyrite LINE-TYPE Arresters (20 to 73 kv Ratings) Provide:

1. *Liberal Discharge Capacity*—Withstand 65,000 ampere discharge (5 x 10 ms wave). The Thyrite disk valve element, 3½ in. dia., provides cross-sectional area and thermal capacity unusually liberal for line-type arresters. Ceramic insulating collar, integral with the Thyrite disk, is an exclusive G-E feature for added reliability.
2. *Performance Unaffected by Atmospheric Conditions*—Sealed arrester unit construction with Thyrite shunted and shielded gap elements results in arrester sparkover voltage which is unaffected by rain, fog, sleet or stray electric fields.
3. *Flexibility of Application* — Four basic arrester units, 20, 25, 30, and 37 kv maximum, provide arresters of corresponding ratings, and these can be assembled two in series to form arresters of higher voltage ratings. This unit construction first introduced with Thyrite line-type arresters in 1937 enables substantial economies in application.
4. *Variety of Mountings*—Arresters may be base-mounted on foundations, on substation structures, on crossarms using available mounting brackets, or suspension-mounted by the line terminal cap. Because the Thyrite shunted gaps make the arrester protective characteristics identical for either polarity of impulse voltage, the arresters may be directly suspended to substation structure with ground connection at top of arrester and line connection at the *bottom.*

Thyrite line-type arresters enable economical protection for the numerous small substations (1000 kva or less) in the medium transmission range of 23 to 69 kv.

Thyrite *line-type* arresters allow apparatus to be stressed approximately 25 per cent higher (IR voltage drop) than when protected by Thyrite *station-type* arresters. The line-type will pass about 75 per cent *less* lightning current than the station-type for the same protection level. However, Thyrite line-type arresters will usually afford economical protection commensurate with small substation investment.

FOR PROTECTION OF SMALL SUBSTATIONS



Lightning Arresters

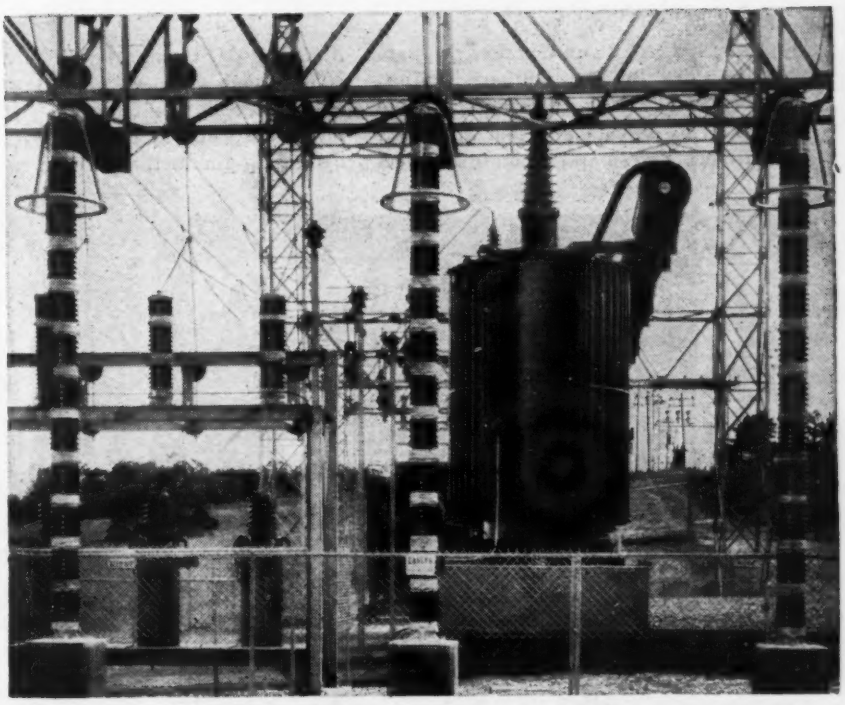
Generating Station and Substations

Thyrite STATION-TYPE Arresters (3 to 242 kv Ratings) Provide:

1. *Exceptionally Large Discharge Capacity*—Easily withstand lightning discharge currents of 100,000 amperes (5 x 10 ms wave). Thyrite valve disks (6 in. dia.) provide a cross-sectional area and thermal capacity unobtainable in any other arrester. The ceramic insulating collar, integral with Thyrite disks, is an exclusive G-E advance for endurance to severe discharges.

2. *Consistently Low Impulse Sparkover*—assured by the preionizing element inherent in the series gap unit of each arrester unit.

3. *Exclusive Interchangeable Unit Construction*—Standard Thyrite arrester unit of 11.5 kv normal rating is *common to all standard system voltages*—23 to 230 kv. Thyrite arresters are a *permanent investment*—interchangeable units are never made unusable by changes in system voltage. For example, the standard 6-unit arrester for 69 kv ungrounded neutral service can be easily modified for 69 kv grounded neutral service simply by removing one arrester unit from each single-pole arrester. The released units are applicable to arresters of other ratings.



FOR PROTECTION OF IMPORTANT POWER STATIONS AND SUBSTATIONS

4. *Performance Unaffected by Atmospheric Conditions*—Gap elements, shunted and shielded with Thyrite and sealed in a separate porcelain container, result in an arrester sparkover voltage which is unaffected by rain, fog, sleet, stray electric fields, or polarity of applied lightning impulse. The small leakage current thru the gap-shunting Thyrite resistors maintains an internal temperature about 3 C above ambient—assuring freedom from atmospheric moisture or internal condensation.

5. *Self-supporting Construction*—requires no bracing insulators—up to and including 121 kv arrester rating. Minimum space for installation—whether on foundations, station structures, mounting brackets or directly on power transformers, permits location of arresters close to apparatus being protected.

6. *Small Physical Size and Weight*—The heaviest part—the 11.5 kv arrester unit weighs only 80 pounds. Usually only a stepladder, and a wrench for tightening bolts between units are needed for assembly. Three-point bolting of standard units avoids straining of porcelains and saves installation labor.

Thyrite station-type arresters provide the *most efficient and enduring* protection for generating stations and substations. Available for standard circuit voltages from 2.3 to 287 kv, they are recommended where either the investment in power equipment to be protected, or the importance of power service continuity, warrant the *highest degree* of protection.

(Assuming even moderate prevalence and severity of lightning, the selection of station-type arresters is usually warranted for protection of power equipment or substations above 1000-kva capacity.)

THYRITE arresters easily meet ASA and AIEE standards for lightning arresters.

For further information on G-E lightning protective equipment for a-c rotating machines, ask for Bulletin GEA-1743; GEA-2978 on THYRITE *line-type* arresters, and GEA-1304 on THYRITE *station-type* arresters. Write to *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

Since THYRITE arresters were introduced in 1930, many thousands of them, on circuits from 2.3 to 287 kv, have established a protection record in service unequalled by any other means of station protection.

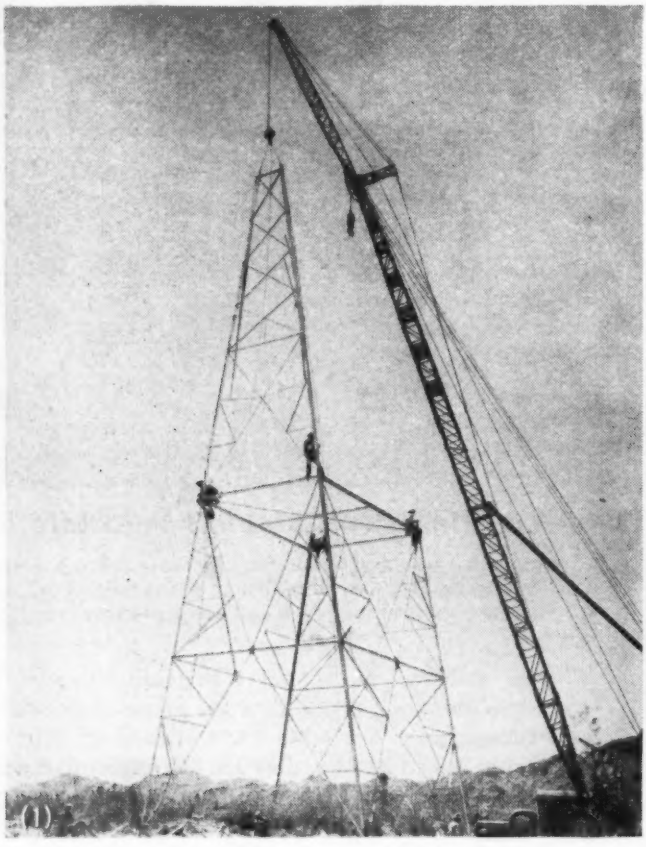
GENERAL ELECTRIC

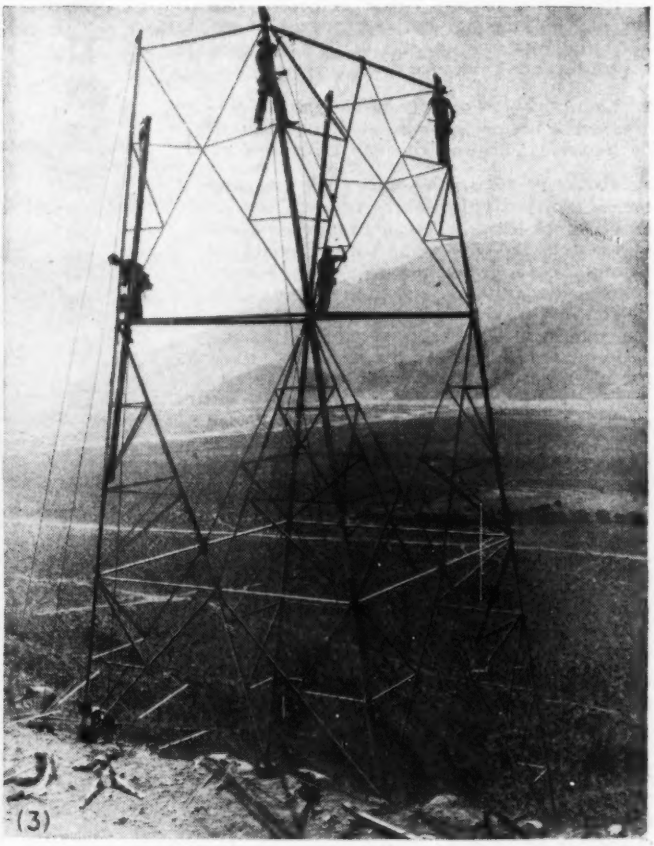
405-23-5600

Three Methods of Erecting Towers

JORDAN LUMMIS, Transmission Engineer, Southern California Edison Co. Ltd., Los Angeles, Calif.

IN THE RECENT construction program on the third Boulder-Southern California Edison 220-kv. transmission line three forms of mechanization were used as circumstances required on tower erection. Crawler-type crane (Fig. 1) with 105-ft. boom was used where tower sites were accessible. Opposite sides of tower were hinged into place (Fig. 2) by falling-gin method where room for ground assembly existed and site was inaccessible to crane. Member-by-member erection (Fig. 3) was resorted to at some less favorable sites such as in rugged terrain.


(1)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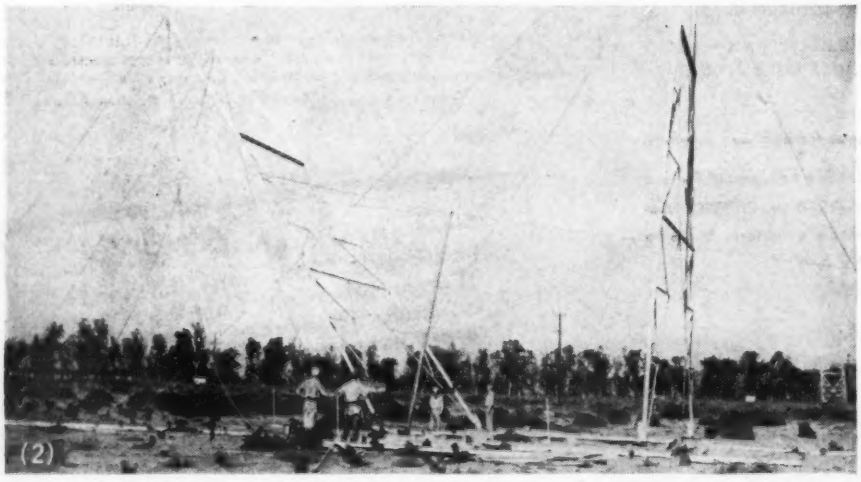
(2)

Opposite-face and piece-by-piece methods of erection are well enough known but the use of crawler-tread traveling cranes is not so common. The cranes were used for lifts up to 100 ft., which was sufficient for the majority of towers. Towers extending beyond the crane's limit were "topped out" by hand.

Disadvantages of the crane are that it is too cumbersome for use in orchards and that it cannot travel with the boom erect. This latter fact excluded it from use where roads are not reasonably straight because the lowered boom supported on a dolly cannot be maneuvered at sharp turns.

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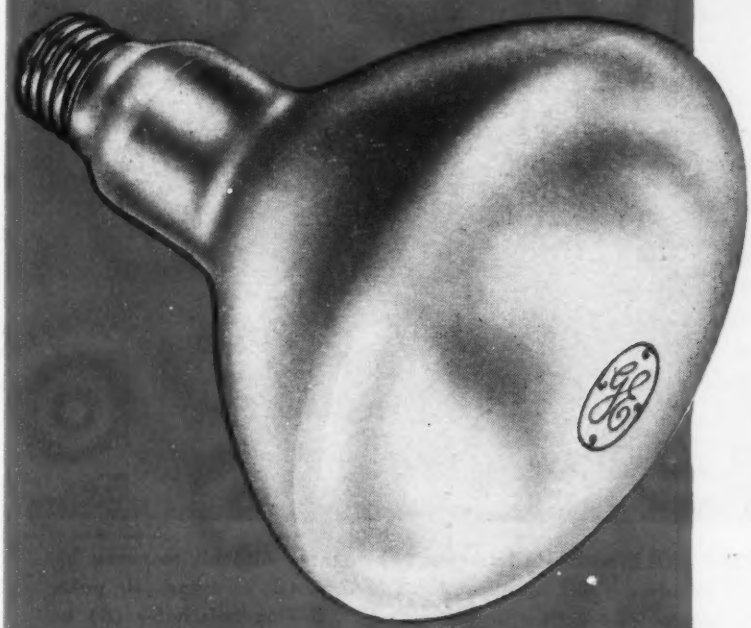

G·E LAMPS

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★

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A lot of comfort and convenience for a low price. Winter chills and ills create dozens of uses for a G-E heat lamp in every home—it soothes aches and pains, warms folks on chilly mornings, thaws pipes, dries shampooed hair, nail polish, paint, stockings, glue. And everyone can buy this handy lamp right now for only $1.25!

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2. THE DEALER WINS!

Here's a mid-winter merchandising opportunity that pays off. Right when consumer demand is at its peak, plenty of standard G-E heat lamps are available for immediate delivery—for volume sale at a bargain price. And in January we're backing dealers with a hard-hitting program of special promotion and national advertising on heat lamps.

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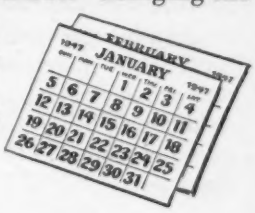
3. THE UTILITY WINS!

Now's the time to use this popular G-E heat lamp as a door-opener for your home lighting advisors. It's a help in building the friendship of consumers. And it plays an important part in General Electric's program for "bringing the sun indoors." Remember, a 250-watt G-E heat lamp in every home can be a real load-building plus!



Put G-E heat lamps on your winter Promotion Docket

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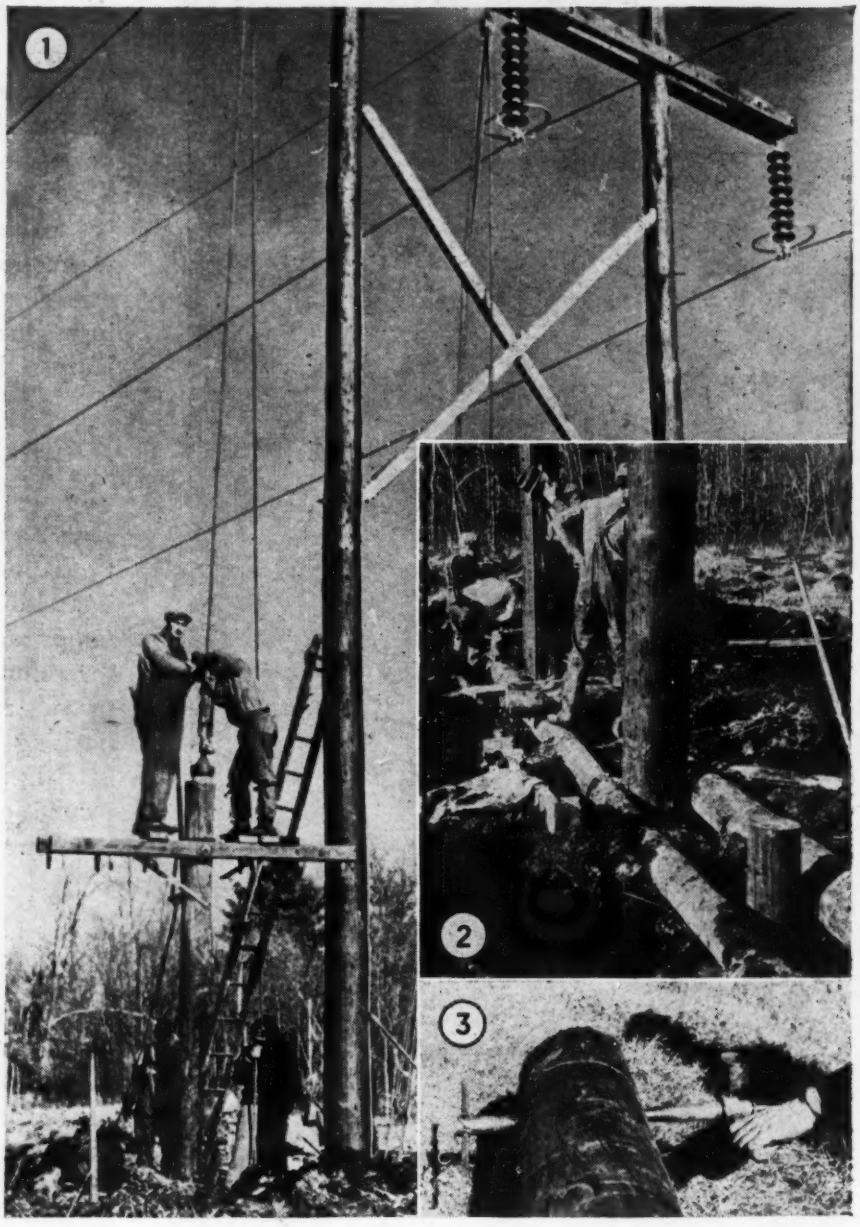
Setting H-Frames in Soft Soil

FOUNDATIONS in soft soil presented a problem in the construction of a 115-kv. eastern transmission line where H-frames of creosoted southern No. 2 poles were used to support three 4/0, 7-strand, hard-drawn bare copper power conductors.

The conductors were spaced 14 ft. apart on centers, strung to an ultimate tension of 4,000 lb., with two overhead ground wires of $\frac{3}{8}$-in. Bethanized steel connected by flving taps to a counterpoise, and having heavy-duty, ball-and-socket insulators with grading ring at the conductor end, eight units in suspension and nine in dead-end strings. Double-plank crossarms with wooden filler blocks were used in the frames.

Basic pole height was 55 ft. for 25-ft. ground clearance. To provide suitable foundation in soft soil, hard bottom having been found at 25-ft. depth in extreme cases, the following procedure was taken: Three 30-ft. poles were driven to serve as piles for the support of the H-frame. One pile pole was driven in the middle of the H-frame site and one outside each of the two H-frame poles. These three piles were then tied to the line or H-frame poles by two 35-ft. horizontal poles which were bolted to the piles and line poles.

The driving equipment for the piles was made up of air hammer and backfill tamper to which was welded a collar which would slip down over the pile. To overcome the handicap of inaccessibility to the compressor truck, a booster tank was cut into the air line to maintain proper volume and pressure of air. Bolt holes were field-bored by a Greenlee pressure gun and were 11/16 to 15/16 in. in diameter.



DRIVING PILE POLE with air hammer (1) in area difficult to reach by truck because of adverse soil conditions . . . Method (2) of tying pile poles and H-frame line poles together in soft soil . . . Boring bolt holes (3) in poles by pressure gun, exact location determined at the job

• • •

Procedure for Interrupting Service

TO MINIMIZE inconvenience to customers an eastern utility has established procedure for service interruptions scheduled to meet operating needs. Arrangements are by a maintenance supervisor and are cleared through him. Cutoffs are planned when possible between 1 and 5 a.m. Sundays or other days as second choice, except in emergencies. At least 24 hours' notice to the supervisor is normally required. "Important customers" are defined as power users, large lighting users or others having special processes or services demanding their notification before cutoff.

Whenever possible customers are notified in advance, the name of the person consenting recorded and given the trouble operator if the cutoff is to be outside business hours. If any customer complains of receiving no advance notice, his name is recorded. Small groups of customers presenting no special problem (as in residential blocks) are directly notified by the foreman or department official in

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charge of the work, through crew members so detailed to state the time and probable duration of cutoff.

Refusal of a customer to permit cutoff is referred by the foreman to his superior before proceeding with the work. Latitude is given as to notifying all customers (where large numbers are involved) or important users as above outlined. If one or more complete circuits are to be cut off, the distribution superintendent, his assistant, or if both are absent, the man in charge of unusual trouble must be notified ahead of making arrangements.

When work done during company office hours requires customer cutoff, the department head in charge sees that the maintenance supervisor is told in advance the time and expected duration of the interruption. The above head or the foreman on the job immediately informs the supervisor when service is restored. Outside office hours cutoffs require trouble operator notification and report by him to the supervisor. Commercial service cutoffs are recorded in detail as to place, time and restoration, and the meter superintendent notified so that company-owned electric clocks may be examined and reset.

Information Kept

The maintenance supervisor keeps a card record of customers to be notified in case of planned cutoff. These are filed numerically by primary circuits and sub-filed alphabetically by transformer banks. If duplicate service exists, filing is by regular supply circuit number plus a reference to the duplicate line.

This record includes many useful details such as the type of service, customer's telephone number, location of transformer bank, name of individual to be notified, memoranda as to special apparatus (such as heat-treating equipment, incubators, milkers, etc.) and is kept up to date. A company constant current transformer fed by a primary circuit is recorded as a customer, details of automatic control, etc. being kept. Different types of service from different primaries require separate records, but with cross references.

The general line foreman informs the maintenance supervisor of work requiring disconnection of customers, load shifting between circuits, changes in sectionalizing, and interconnections, and completion of the work. The maintenance supervisor is notified when a meter for an important customer is connected or disconnected. Annually during the first half of July the supervisor examines every card in the file, checking telephone numbers and making necessary corrections. The departmental records and plans clerk also keeps a record of all important customers, corrections being made weekly on the day when circuit maps are corrected. Other copies of this list of customers are kept by the general office and by the trouble operator.

•

Capacitors Improve Load Characteristics

TESTS by the Hartford Electric Light Co. in a local industrial plant indicated an 11.5 percent overload on a 400-kva. transformer bank serving an important section of the factory, although an 84 percent power factor was noted. The company needed to add eleven motors totaling 37.5 hp. and about 3.5 kw. in lighting. The power sales department pointed out that the bank would not take added load safely without an improvement in power factor. The measured demand on the bank at 84 percent power factor was 446 kva., the rkva. being 241.6. It was estimated that the expanded load could be handled on this bank by installing enough capacitors to raise the power factor to 90 percent. This called for 61.6 rkva. net added, or the difference between 241.6 rkva. and 180 rkva. resulting from the increase in power factor to 90. The capacitors required much less scarce material than would have the installation of larger transformers. The industrial plant added ten 7.5-rkva. in capacitors, or 75 rkva. total. The demand was 374.4 kw. in this installation.

In another section of the factory a second 400-kva. transformer bank had a measured load demand of 362 kva., or 220.8 kw. at 61 percent power factor. The reactive was 288 rkva. If the power factor was increased to 90 percent the reactive component would drop to 107 rkva. and the demand to 244 kva. This called for 181 rkva. in correction. The factory planned to add 17.5 hp. in motors and 12 kw. in heating equipment. As the transformer bank still sufficed for the load, the addition of the second group of capacitors was temporarily postponed despite the low power factor.

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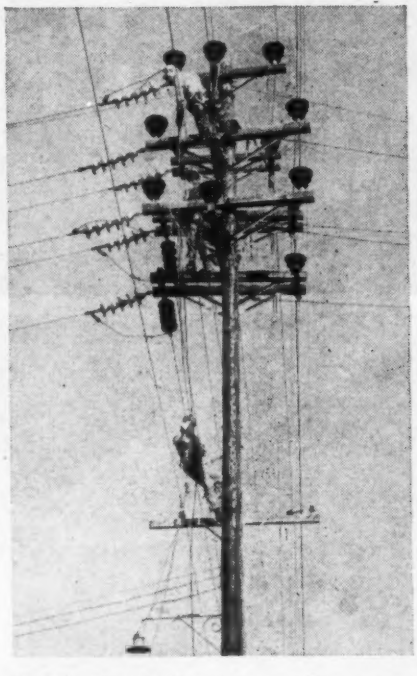
Second 44-Kv. Circuit Installed Safely



DOUBLE 44-kv. line under construction; tap at left supplies a manufacturing plant

EXPANSION of electrical facilities in the Gadsden District of the Alabama Power Co., due to increasing load in the area served by the Dwight Mill-Attalla 44-kv. line, necessitated the installation of a second circuit. The job in general consisted of the following operations:

1. Transferring one No. 2 bare hard-drawn copper conductor from one side of pole to other side for a distance of 2.3 miles.

2. Replacing all top 4-ft. crossarms with standard 6-ft. crossarms on all poles where the standard arms were not already in place.

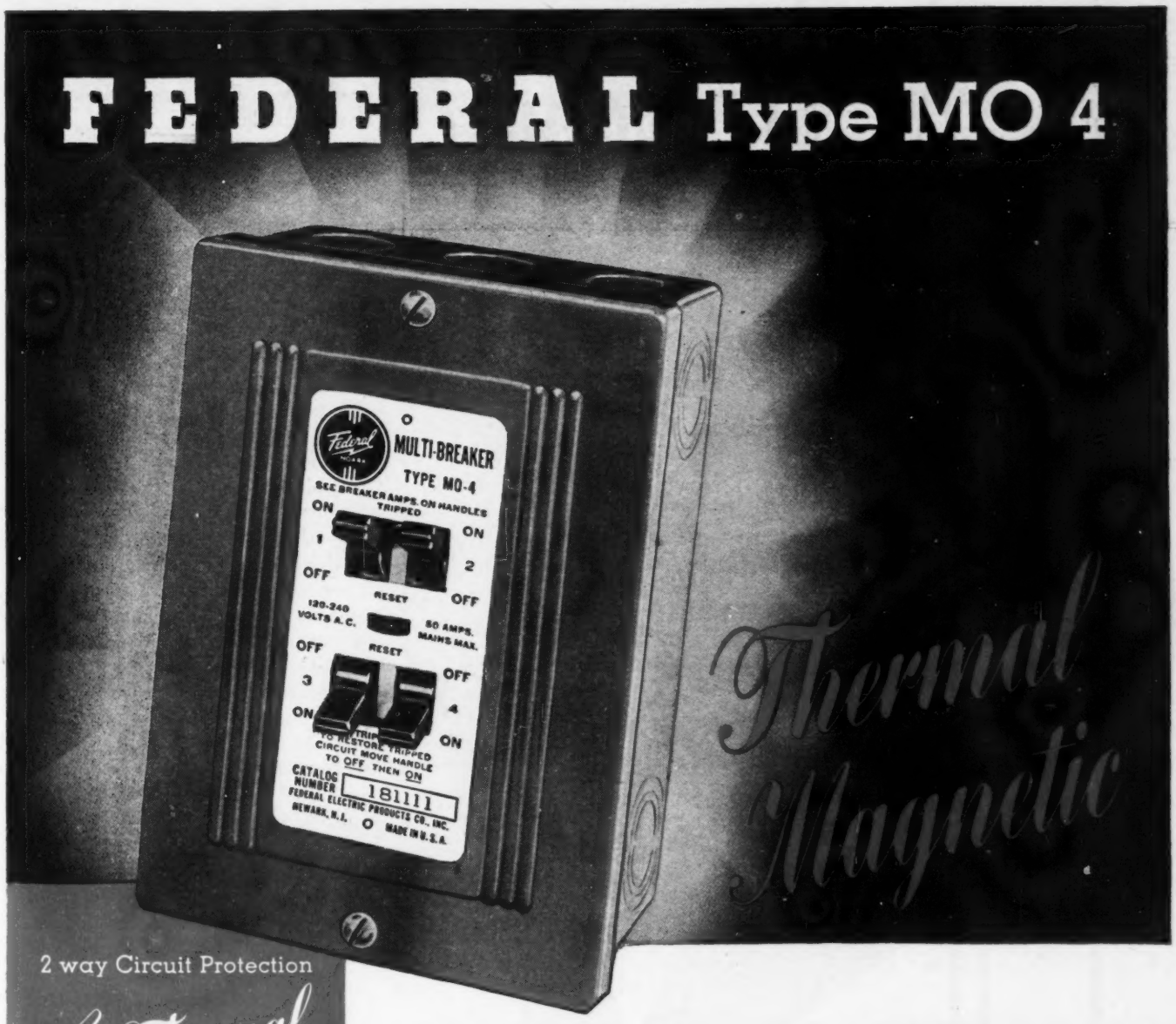
3. Replacing all existing 4 or 5-ft. bottom crossarms with 8-ft. arms.

4. Adding a 10-ft. crossarm on each of 53 poles.

5. Replacing 36 poles with higher poles to provide additional clearance at specific locations.

6. Stringing 2.3 miles of three No. 1 three-strand bare hard-drawn copper conductors and installation of

FEDERAL Type MO 4



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● 4-pole range ● For flush or surface mounting ● Only 5 1/16" x 7 3/16" x 2 7/8" ● Wire ratings 15, 20, 30 amp. ● Ideal wherever two lighting or appliance circuits and a small electric range circuit are needed . . . or where four lighting or appliance branch circuits are needed.

FEDERAL ELECTRIC PRODUCTS COMPANY—Executive Offices: 50 Paris Street, Newark 5, New Jersey. Plants: Hartford, Connecticut; Newark, New Jersey; St. Louis, Missouri.

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Write for Bulletin No. 154

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necessary hardware, insulators, etc. for second circuit.

7. Installation of 0.5 miles of double-circuit line on new right-of-way on the Attalla end.

Numerous problems were involved in the safe handling of this job as there were one or more of 4-kv., 3-phase primary, arc, company telephone, and secondary circuits attached to the 44-kv. poles where the work was to be done.

First consideration was to plan some means of taking the 4-kv. circuit out of service in the section where work was being done without service interruption to any customers or to only a small number at any time. To accomplish this, the method used was to string in temporary 4-kv. circuits from other primary lines, reconnect distribution transformers to different phases, and install temporary disconnects. The temporary installations made it possible to work on the high line poles with the 4-kv. circuit dead at times, and at other times only one outside phase was "hot."

Due to voltage conditions, it was necessary to do all work on the single 44-kv. line; four Sundays were required, at which time the Dwight-Attalla 44-kv. line was out of service. All preliminary work on that line was done during the week. After all of the poles were framed, the second circuit was installed with the other one energized.

This complex job was completed within 49 days after it was started, without a disabling injury accident.

•

Switch-Door Window Aids Fire Extinction

JOSEPH W. ST. ANDRE
Maintenance Supervisor
Wright Aeronautical Corp.
Wood-Ridge, N. J.

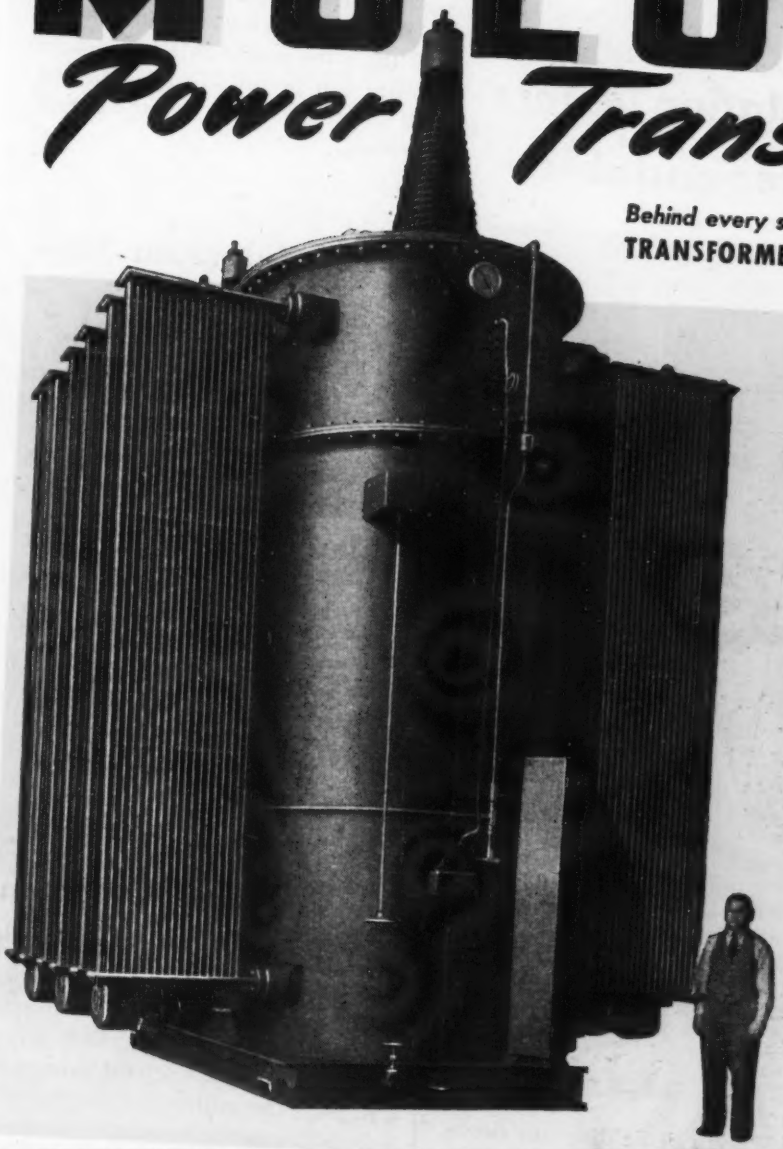
THE PROBLEM of locating and extinguishing fire in a switch gallery without opening the switch-room door was rather simply solved at the Wood-Ridge, N. J., plant of Wright Aeronautical Corp.

Cutting a 7- x 7-in. opening, head high, in the metal-clad door and inserting a non-reinforced plate-glass window in the aperture provided two advantages:

(1) Locating and determining the

MOLONEY
Power Transformers

Behind every step . . . **OVER 50 YEARS OF EXCLUSIVE TRANSFORMER MANUFACTURE AND RESEARCH**

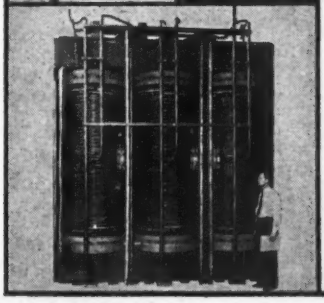


Research and experience are your assurance of plus performance. For not only has Moloney, throughout the years, concentrated solely on the manufacture of Transformers, but during these 50 years, Moloney has accumulated a wealth of data which through skillful application has brought about continuous improvement in design and performance. Your transformer, built by Moloney has the benefit of concentrated experience and wide research . . . unexcelled in the electrical industry.

Illustrated: Power Transformer rated 25,000 Kva, 161,000Y to 13,200 volts.

Engineering Research, the vital factor in improvement of design, processing and fabrication, has earned for Moloney the title of Pioneer in the Transformer field. It is the reason industry looks to Moloney for new developments in design and efficiency.

Core type construction is standard on all Moloney Power Transformers, thus maximum amount of winding surface is exposed to oil. Circular windings provide greatest possible protection against distortion under the most severe operating conditions.



Tanks are made of high grade steel, electrically welded, with rugged Z-bars or sturdy, welded, box type reinforcement. Bases of heavy channel iron construction prevent distortion of base or tank when handling. Careful pressure testing assures leakproof construction.

Preparing to test a power transformer. Besides numerous test boards for standard transformer tests, the Moloney 2,500,000 volt surge generator, with its recording cathode ray oscillograph, is available for impulse testing.

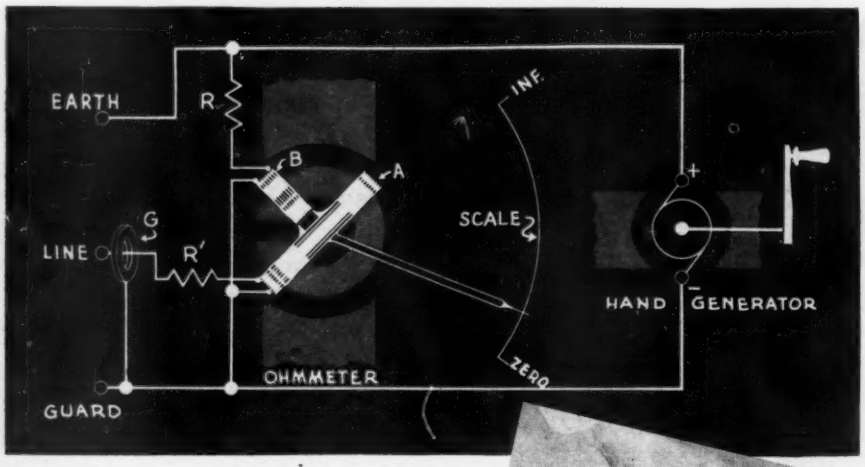
. . . OVER 50 YEARS OF LEADERSHIP IN DESIGN, RESEARCH, ENGINEERING

MOLONEY ELECTRIC CO. • ST. LOUIS 20, MO.

POWER AND DISTRIBUTION TRANSFORMERS EXCLUSIVELY SINCE 1896

Here's why—

"MEGGER"* Insulation Testers are always dependable—



In what we term a cross-coil true ohmmeter, two coils are mounted in fixed relation to each other on the same pivot-and-jewel moving system in the field of a permanent magnet. "Current" flows in coil A and "potential" in coil B, and they are connected so that their respective torques oppose each other. Since there are no control springs, the opposing coils give a true ratio of E/I, and ohms (or megohms) are indicated by a pointer over a scale. The readings are independent of the voltage of the hand-driven d-c generator, because any change in the voltage affects both coils in the same proportion.

The "Megger" instrument is simplicity itself. The circuit diagram shows *all* elements—hand-cranked generator, fixed resistance coils and ohmmeter with pointer and scale. Nothing more is needed and nothing could be simpler. In making resistance tests, you merely connect leads from the instrument to the apparatus or circuit under test, turn the crank for a few seconds, and read the insulation resistance directly on the scale.

Power generation and distribution practice has dictated certain standards of quality and performance that every piece of electrical equipment is expected to meet. "Megger" insulation testing instruments have been and will continue to be built in conformity with these high standards.

For complete descriptions and applications of all types of "Megger" Insulation Testers write for Catalog 1685-W.

**Trade Mark U. S. Pat. Off.*

James G. BIDDLE CO.
ELECTRICAL & SCIENTIFIC INSTRUMENTS
1316 ARCH STREET • PHILADELPHIA 7, PENNA.

severity of the fire without incurring the additional draft hazard of an open door.

(2) By breaking the glass and placing a fog-nozzle in the opening, the fire can be quickly extinguished with increased safety to fire-fighting personnel.

•

Durable Substation Signs

ORDINARY RAISED METAL LETTERS have been found to make suitable signs for certain types of substations by the San Joaquin division of Pacific Gas and Electric Co. Painted signs weather badly. Enameled signs, although used, are more expensive

•

Wall Thicknesses For X-ray Protection

CONCRETE WALLS 51 in. thick will afford adequate protection against 2,000,000-volt broad-beam X-rays, and walls 36 in. thick against those of 1,000,000 volts, when the subject is 4 ft. from the source and the current is 3 milliamperes, according to data reported in the August, 1946, *Journal of Research* (RP1735) with further announcement in *Technical News Bulletin No. 353*, both publications of the National Bureau of Standards, Washington, D. C. These are maximum thicknesses representing about the most severe conditions that may be encountered. At greater distances and with smaller currents, walls of less thickness will afford satisfactory protection.

The extensive industrial use of X-rays for inspection purposes necessitated precautions to protect the health of the large number of workers in this field; it is estimated that there was a 2,000-percent increase in personnel engaged in this type of work during the war. Although it has long been known that X-ray work can be carried out with complete safety when proper precautions are taken, it was

Thousands of tests, under all kinds of service conditions, prove that "Dutch Boy" Red Lead gives metal extra protection

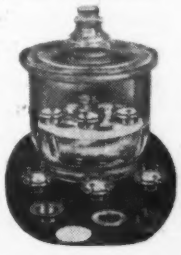
4 Ways RED LEAD RESISTS EFFECTS OF WATER ...guards against Rust

Maintenance engineers have long recognized Red Lead as the "standard" metal protective paint. This acceptance is based, to a great extent, on its marked ability to stand up against moisture, a powerful factor in the rusting process.

Now, scientific research into the inherent properties of the pigment itself, shows just how and why Red Lead resists the effects of water. Briefly, there are four reasons:

1. Red Lead resists water "pick-up"—If a series of various metal protective paint films are weighed and then submerged in water (salt or fresh), it is readily noticed, on reweighing after several days immersion, that Red Lead films have outstanding resistance to the absorption, or "pick-up," of water.

2. Red Lead resists passage of moisture—Rusting of metal will not take place if water does not penetrate the paint film to reach the metal.



***Testing Water Permeability of Paint Films**—With this standard apparatus a measure of the amount of water that passes through a unit of film is obtained.*

Experiments show that a straight linseed oil film allows three times as much water to pass through the film as when the same film is pigmented with Red Lead.

Water permeability tests of paint films (see illustration at lower left) show, beyond question, that Red Lead is one of the most effective metal protective pigments, because of its stubborn resistance to the passage of moisture through the film.

3. Red Lead resists solution by water—The action of water on paint films results in a partial dissolving of the film. Many metal protective films lose a considerable percentage by weight of their films through solution in water. On the other hand, the solubility losses of Red Lead paint films are practically negligible.

4. Red Lead resists distortion by water—Red Lead films have little tendency to shrivel or change in size during immersion in water. This is imperative to good metal protection. For good protection depends on good adhesion, and a paint film maintains better adhesion when it is not distorted by the action of the water.

* * *

Remember, too, Red Lead is compatible with practically all vehicles commonly used in metal protective paints, including all fast-drying resins.

Specify RED LEAD for ALL Metal Protective Paints

The value of Red Lead as a rust preventive is most fully realized in a paint where it is the only pigment used. However, its rust-resistant properties are so pronounced that it also improves any multiple pigment paint. No matter what price you pay, you'll get a better paint for surface protection of metal if it contains Red Lead.

WRITE FOR BOOKLET—"*Red Lead in Corrosion Resistant Paints.*" This authoritative guide is available to those responsible for specifying and formulating paints for structural iron and steel. It describes in detail the scientific reasons for Red Lead's superior protection. It also includes typical specification formulas. If you haven't received your copy, address nearest branch listed below.

* * *

The benefit of our extensive experience with metal protective paints for both underwater and atmospheric use is available through our technical staff.

NATIONAL LEAD COMPANY: New York 6; Buffalo 3; Chicago 8; Cincinnati 3; Cleveland 13; St. Louis 1; San Francisco 10; Boston 6, (National Lead Co. of Mass.); Philadelphia 7, (John T. Lewis & Bros. Co.); Pittsburgh 30, (National Lead Co. of Pa.); Charleston 25, W. Va., (Evans Lead Division).

DUTCH BOY
Reg. U.S. Pat. Off.
RED LEAD

EXTRA STURDY CONSTRUCTION

. . an Important PLUS VALUE in Buell's systems of

Dust recovery

To stand up under the severest conditions of continuous usage, cyclone bodies and cones in Buell Dust Recovery Systems are fabricated of extra-thick steel, completely seal-welded inside and out and ground flush to form a smooth, homogeneous surface. Hoppers are braced and stiffened with 3" channels to resist vibration.

This extra-sturdy type of construction is possible only with large-diameter cyclones and is one of the plus values that have made Buell Dust Recovery Systems famous throughout industry for long life and low maintenance. Due to their sturdy construction Buell installations have been in service three, four, five or more years without the replacement of a part.

How the patented "shave-off" of the van Tongeren cyclone (found only in Buell Dust Recovery Systems) makes it possible to use large diameters and, at the same time, obtain high collection efficiencies is fully described in a 28-page book: "The van Tongeren System of Industrial Dust Recovery." We will be pleased to send you a copy without charge. Write for it today.

Six exclusive Buell Features

1. THE "SHAVE-OFF"
2. LARGE DIAMETERS
3. EXTRA-STURDY CONSTRUCTION
4. CORRECT HOPPER DESIGN
5. SPLIT-DUCT MANIFOLDING
6. INNER WELDS GROUND SMOOTH

BUELL ENGINEERING COMPANY, INC.
8 Cedar Street, Suite 5000, N. Y. 5, N. Y.
Sales Representatives in Principal Cities

buell
DUST RECOVERY SYSTEMS

DESIGNED TO DO A JOB
NOT JUST TO MEET A "SPEC"

necessary to establish detailed specifications for safeguards in this particular service. No data directly applicable to industrial conditions were available, as all previous efforts had been directed toward protection from narrow beams, that react in an entirely different manner from the broad beams used in industry. Accordingly, a committee of the American Standards Association, with George Singer of the Bureau's X-ray Section as chairman, undertook the development of a safety code for the industrial use of X-rays. This code has now been adopted as an American War Standard, Z54.1-1946.

Making use of the best biological information available, the committee adopted a permissible daily dose of 0.1 roentgen per day. In other words sufficient protection must be interposed between the source and a person so that he will receive no more than 0.1 roentgen in 24 hours.

As one phase of the program, absorption measurements were obtained for broad beams of 1- and 2-million-volt X-rays, at the laboratories of the General Electric Co. in Schenectady, by Carl B. Braestrup of the Department of Hospitals, New York City, and Harold O. Wyckoff and George Singer of the Bureau staff.

The observations were made in a room equipped with a clear opening between X-ray source and the ionization chamber used for determining the strength of the radiation. The opening, a doorway, was closed with concrete blocks that were built up in layers to make walls of different thicknesses. Suitable precautions were taken that there were no leaks around and between the blocks, so that radiation measured was actually radiation which had passed only through the concrete.

The results are presented in curves and tables showing the thickness of concrete (density, 2.35 g/cm^3, or 147 lb./ft.^{3}) required for primary protective barriers, for operation at different currents and at different target distances. A correction should be applied if the concrete is of another density. Although described as preliminary results, they represent the best technical data as yet available, and are considered sufficiently reliable for the present purposes. As higher voltages are becoming available for use in generating X-rays, the work is being extended, with refinements in apparatus and procedure.

He writes only in RED INK!

INADEQUATE WIRING, the industrial jinx, embezzles millions every year. It would take quarts of red ink to record the toll he takes in unproductive wages, lost production and spoilage.

For, when he attacks, through overloaded, over-extended, obsolete wiring, efficiency can drop from 25 to 50 percent.

To shut out this costly scribe, talk to your plant power engineer, consulting engineer, electrical contractor or power salesman.* They can write him off... before he gets into your books.

*WIRE AHEAD, a new booklet discussing preventive maintenance... the symptoms of inadequate wiring... and presenting plans for anticipating electrical demand, is now in preparation. We shall be glad to send it on request as soon as it is available.

ANACONDA from mine to consumer

ANACONDA WIRE & CABLE COMPANY

LOAD BUILDING

Induction Heating Speeds Silver Soldering

INDUCTION SOLDERING joins four blades and shanks in 12 sec.

L. GISE and J. R. STEWART
Westinghouse Electric Corp.
Philadelphia, Pa.

WHEN APPLIED to the soldering of stainless steel kitchen utensils at the Adel Precision Products Corp. of Huntington, W. Va., induction heating resulted in an increased production rate, in a reduction of labor costs, and in an improvement of the quality of the product.

Under the discarded system of hand soldering, only one utensil could be turned out by one man per minute. In this production, many turnbacks were encountered, and machine polishing of the finished product used up much additional time before the utensil was ready for packaging. Welds were unsatisfactory, and labor costs were considered too high.

Consequently, Mr. Charles W. Hawk, the corporation's project engineer, recommended the installation of a 20-kw., 450-kc. generator. Ten women and two men form the production line to turn out sets of six items—two forks, two spoons, a cake turner and a spatula.

Preparations include the application of silver solder and flux and placing of parts in frames for heating.

A ferrule and a shank are soldered in a coil of twelve single turns in series by a 15-sec. heating cycle of 1,250 deg. F. to give the joint the required tensile strength. Then a plastic handle is fitted around the upper shank and into the ferrule.

Blades and shanks are soldered by being placed in very close proximity to a unit of four coils in series. Each coil is made in approximately three-quarters of a turn. A heating cycle of 12 sec. is applied to seal the joints.

An evaluation of the costs of this installation reveals considerable savings. The initial investment, including the high-frequency generator, work coils and production line, was about $10,000. Total operating costs amount to approximately $10 per hr. for labor and $0.80 per hr. for the generator. The latter figure includes power cost at the rate of one cent per kw.-hr., tube replacements based upon 5,000 hr. average life, and amortization of the generator over a period of 30,000 hr. operation.

With a production of 1,500 sets of six utensils per 15-hr. day, the actual operating cost is 10.8 cents per set or $162 per day. To accomplish the same production by the "torch" method it is estimated that 20 skilled men would be required with a total cost of $390 per day for labor alone. Thus high-frequency heating results in a saving of $228 per day which pays for the initial cost in two months.

Power input for full generator output is 43 kva., 3 phase, 60 cycle, at 95 percent power factor. Control is by means of a "start-stop" button mounted on the face of the cabinet and the automatic timer deenergizes the unit after the set time has elapsed. A current transformer connected to the output terminals of the generator is used to step up the current in the induction work coils, resulting in a marked increase in heating rate.

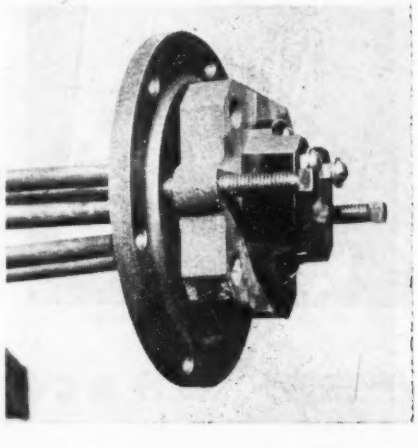
Inexperienced personnel were found to be no drawback to the efficient operation of the unit, once it was tuned up. As a result, the company was able to release skilled workmen for more important jobs.

•

How to Remove Scaled-up Water Heaters

SERVICEMEN often experience difficulty in breaking loose scaled-up insert electric water heaters when replacement is necessary. To make it easier to remove such heaters, Pacific

WHEEL PULLER principle is used to pry loose hairpin-type electric water heaters when replacement is necessary because of burnout or for the purpose of removing scale



NO SPOT TOO HOT—

ROCKBESTOS A.V.C.

withstands Heat, Flame and Corrosive Fumes

Baking heat plays havoc with most wire insulations — causes them to lose resilience, become brittle and eventually crack open to set up failures. Where such a condition exists, your best bet is to install Rockbestos A.V.C. Its *impregnated felted asbestos* insulation provides the needed resistance against excessive heat — protects your installation also against moisture, corrosive fumes, oil, grease and oxidization.

By specifying Rockbestos A.V.C. for *all* hot spot installations, you can be sure of continuous trouble-free service and lower maintenance costs.

Rockbestos A.V.C. wires and cables are available in 125 standard constructions in 600 to 5000 volt ratings — single or multi-conductor — plain, lead sheathed or armored. Write for catalog and samples.

ROCKBESTOS PRODUCTS CORPORATION
174 Nicoll Street, New Haven 4, Conn.

Rockbestos A.V.C. 600 Volt Power Cable-Code Type AVA— will operate under temperatures ranging up to 230° F.

The cable illustrated and similar types rated up to 5000 volts assures trouble-free performance in hot locations with this construction:

- A tough impregnated asbestos yarn braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.
- Heat, flame and moisture resistant impregnated felted asbestos insulation that won't dry out, crack, flow or rot.
- Asbestos-protected varnished cambric for high dielectric strength and added moisture resistance.
- Inner wall of impregnated felted asbestos that withstands conductor-heating overloads and won't bake brittle or burn.
- The conductor is perfectly and permanently centered in helically applied non-flowing insulation that provides greater current carrying capacity.

One of the 125 different constructions designed by Rockbestos for severe or unusual operating conditions.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND DETROIT CHICAGO PITTSBURGH
ST. LOUIS LOS ANGELES SEATTLE SAN FRANCISCO PORTLAND, OREGON

"I know they're good... they're KLEINS

"IF you've ever worked on a pole 50 feet in the air with the wind whistling around your ears, you know why linemen need good tools. That's why there'll always be a pair of Kleins in my tool belt. I know they're good."

Yes, to the men who install and maintain the nation's power and communication lines there is only one kind of pliers . . . Kleins. There's a sound reason for this overwhelming preference. For linemen and electricians—men who know good tools—also know of the quality materials and handcraftsmanship that go into every pair of Kleins. To them this excellence means speed, efficiency and safety on every job.

The complete line of Klein Pliers is in full production but demand still exceeds supply. Your supplier will fill your order as soon as possible.

ASK YOUR SUPPLIER

Foreign Distributor:

International Standard Electric Corp., New York

A copy of the Klein Pocket Tool Guide, showing the Klein line and containing valuable tool information, will be sent on request.

Mathias KLEIN & Sons
Established 1857 Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

Gas and Electric Co., at the suggestion of R. H. Russell, has added two cap screws as illustrated to a standard flange plate previously adopted. After the four retaining screws are removed, the two long screws shown are screwed into vacant diametrically opposite tapped holes and by driving them forward against the large outer flange the scaled-up heater is broken loose for easy removal.

P. G. & E. has standardized on these flanges and makes up the assembly shown in its own shops.

•

Power for Dairy Barn Ventilation

THE NEED for ventilation in cow stables is a result of the increased demand for clean, wholesome milk at low cost of production, with a maximum output per cow, including greater yields than formerly in winter. The rural service development department of the New England Power System has recently assembled basic data on the average electrical requirements of dairy barn ventilation for the use of utility farm service salesmen in its territory.

A good ventilation system properly installed and operated will: (1) supply without draft the abundance of fresh air necessary to the health and comfort of cows; (2) make possible control of barn temperature; (3) preserve the building and feed stuffs from mold and rot due to excessive moisture and make spontaneous combustion less likely; (4) provide a measure of disease prevention and control; (5) cool stable in summer.

Job Requirements

The following data are given merely as basic requirements, and detailed installation designs are recommended after consultation with reputable equipment dealers, factory representatives, or government extension service engineers. Usually it will cost more to install flues for natural draft ventilation than to provide motor-driven fans for the same volume of air. Fans are positive and reliable in action, and can be installed without moving hay in mows and with very little labor and material.

Basic data on air needed figure 60 cfm. per 1,000 lb. of animal. The usual assumption is 60 cfm. per adult

an important Step..

taken without a second thought

You step into a modern elevator as unconcernedly as you step into your slippers. You take it for granted that you will be carried up or down swiftly and comfortably. Safety . . . or the lack of it . . . never enters your mind. That is as it should be. But you may be interested in knowing how "Otis Elevators" and "safety" have become practically synonymous.

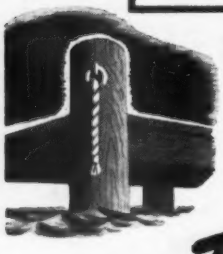
It started 94 years ago with Elisha Otis, founder of this business. At the Crystal Palace Exhibition in New York, he dramatically cut the ropes holding up the elevator platform on which he was standing. His crude "safety device" worked. The world had its first *safe* elevator.

As car speeds increased, as buildings grew taller, safety devices were designed to meet changed conditions. Skyscrapers came of age when Otis was able to "elevator" them. Acceptance of "Otis Safety" has become deep-rooted with the years. And justly so . . . because Otis has promoted safety in every phase of elevator design, construction, installation, operation and maintenance since 1852.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

For the finest in vertical transportation tomorrow, call Otis today. This, too, is an important step you can take . . . without a second thought.

3rd among the features of DIEFLEX



VARNISHED TUBING PRODUCTS IS...

Non-Fraying

FLEXIBILITY

COMPLETE IMPREGNATION

HIGH DIELECTRIC STRENGTH

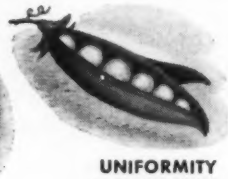
Among the many outstanding features of all Dieflex varnished tubing products is their ability to be cut evenly and cleanly, their return to roundness after cutting, and the fact that they do not back-ravel or fray. Dieflex products are designed to speed production and cut costs!

COMPLETENESS OF LINE

All Dieflex tubings and sleevings of cotton or glass fiber—as well as silicone-treated glass fiber—have this non-fraying characteristic, as well as the many other excellent features listed to the left.

GOOD PUSH-BACK QUALITY

SMOOTH INSIDE BORE



UNIFORMITY OF PRODUCT

INSULATION MANUFACTURERS CORPORATION

Chicago Dayton Cleveland
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INSULATION and WIRES INCORPORATED

St. Louis Atlanta Houston
Detroit Bluefield
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TRI-STATE SUPPLY CORPORATIONS

Los Angeles San Francisco
Seattle

cow. Thermostat control shuts off the fan equipment below 55 deg. F. and starts it at 60 deg. F. The required air volume is obtained by multiplying the number of cows plus the number of 1,000 lb. of young stock, by 60 cfm. For example, assume a 20-cow dairy with a bull, and eight calves of various ages, totaling 2,000 lb. This means 21 mature animals plus the young stock (the equivalent of two mature animals), or 23 in all. This requires 1,380 cfm. of air. In selecting a fan having a maker's rating of at least this total, an allowance would be made for friction and other factors, indicating the desirability of a somewhat larger fan, say of 1,500 cfm. rating.

Fan Application

If the fan and motor have a V-belt drive and step pulleys, the fan speed can be adjusted to the herd size. For herds of more than 25 to 30 cows, or for exceptionally long stables, two or more smaller fans should be considered. A warmer stable usually results where fans are placed in the colder of the long walls, about one-third the length of the barn from the coldest corner, but avoiding driving air out against the prevailing winds. Mounting at window height or higher is desirable, inclosing fans in ducts to reach within 12 to 15 in. of the floor, with trap door in the top for access for inspection and oiling, as well as good circulation in summer.

Careful planning of exhaust systems must be done in relation to manure disposal, and large openings like open hay chutes, broken or badly fitting doors and tilting windows will cause drafts and must be closed. Intake flues are needed wherever persistent odors or con-

Energy Requirements of Fans in Dairy Barns

(Average Operation of 14 Hr. Per Day)

Cfm.*	Hp.	Kw.-Hr. per Month
650	1/40	33
1,270	1/12	55
3,300	1/6	100
7,600	½	168
10,650	½	252
14,500	½	344
17,600	⅝	398

* Propeller type fans

Where and How to Use *Crapo* Steel Conductor

Ask for This Guide to Low-Cost Rural Lines!

If future plans call for the extension of rural service, be sure to ask for a copy of this Manual! A study of its contents will show where and how *Crapo* Steel Conductors can be used to profitable advantage in rural distribution systems.

This illustrated book contains pertinent data on the electrical characteristics and electrical performance of these unique conductors. It shows how construction costs can be reduced by the use of long spans, gives initial and final sag and tension data, describes construction practices, cites typical installations.

Crapo Steel Conductors are especially applicable to rural taps and branches where **construction and maintenance costs are important considerations. The experience of a number of leading utilities over a period of years shows conclusively that *Crapo* Steel Conductors are giving dependable, economical and efficient service on thousands of miles of line in rural areas.**

Crapo Steel Conductors are distributed by Graybar Electric Company, Inc. Ask a Graybar representative for a copy of the *Crapo* Steel Conductor Manual or write direct for Manual No. 110-C.

Indiana Steel & Wire Company
Muncie, Indiana

Crapo Steel Conductors

densation indicate non-circulation of air. Such flues should be about 60 sq.in. in area and direct the air against the ceiling, near the walls. One such intake per three cows is the maximum.

When two small fans are used, each handling about half the air, one may be run at all times and the other controlled by thermostat, or both can be controlled with two thermostats, one of which is set higher. A single fan driven by a two-speed motor can be arranged to drop to half speed if the temperature falls and to snap back to normal speed if the stable becomes too warm. The thermostat should be placed in the fan's outgoing air stream. An automatic shutter that will close when the fan stops and open when it starts prevents equipment freezing in bad weather. For over 50 cows three or four fans are advisable. Not less than one intake per five cows is recommended. If cattle are restless when fans run, cement celotex strapped to exhaust ducts (but without nailing) reduces noise.

•

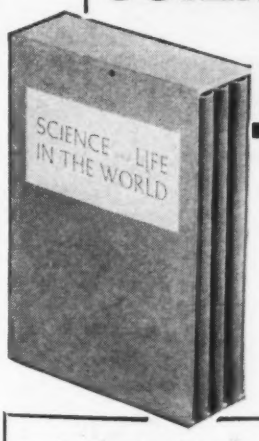
New Lighting Conformed To Architecture

EFFECTIVE LIGHTING smoothly blended into existing architectural design is well exemplified in the entrance foyer of the 521 Fifth Ave. building in New York. The lobby was lighted originally with incandescent fixtures centered in the ceiling panels. The new lighting consists of a single continuous row of 40-watt, white F lamps behind glass diffuser panels set at a 45-degree angle along the sides and at the ends of the lobby. Horizontal illumination is 12 foot-candles. The installation was engineered and the equipment manufactured by the Frink Corp.

What new kind of world are our scientists building?

Now... leading men of science tell you—

HOW THE NEW SCIENTIFIC DISCOVERIES are reshaping our lives



3 volumes, boxed
620 pages, illustrated
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A revealing picture of what famed scientists reported at the recent

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A collection of significant papers presented at the George Westinghouse Centennial Forum, which was held under the sponsorship of the Westinghouse Educational Foundation.

Here for the first time is a series of informative reports on the significance of our tremendous scientific advancement made up through World War II. Recently presented at the George Westinghouse Centennial Forum, they reflect the brilliant thinking of this country's outstanding men of science. Now reported word-for-word in these three volumes, they bring you a sweeping survey of current scientific knowledge and show you new horizons in scientific research and development.

Pertinent questions and answers which followed each subject presentation at the Westinghouse Centennial Forum are incorporated throughout the three volumes. Brief, interesting biographies of the distinguished scientists are also included. For an idea of the scope of these reports see the partial list at the left.

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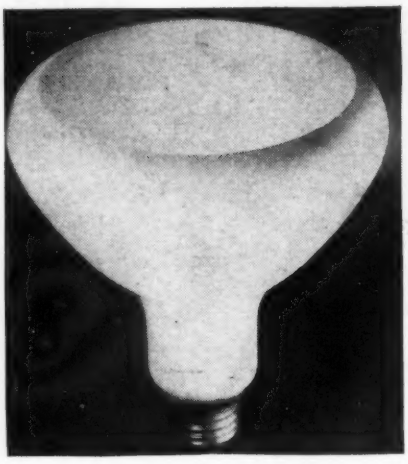
NEW EQUIPMENT

Bulb Diffuses Light Without Diffusion Bowl

A NEW TYPE of electric light bulb, which provides both direct and indirect light without the use of auxiliary equipment when installed in portable lamps, has been announced by Sylvania Electric Products Corp., 500 Fifth Ave., New York. The bulb, called Bolite, is available in 200-watt size only and, because it provides its own diffusion, eliminates the need for the diffusing bowl.

Designed so that it burns base down, the new indirect bulb utilizes two types of diffusion processes. The top, or flat end, of the bulb is frosted to furnish upward diffusion while the lower portion of the bulb has an opalescent coating to provide a greater degree of diffusion of that light which falls directly on the reading or work surfaces.



The new bulb will be sold with special wire lamp shade supports which can be used to adapt existing lamps. These adapters will be available in several styles designed to fit any type of table or floor lamp.

•

New Safety Switch Has Triple Duty Spring

A NEW type D enclosed safety switch in 30-amp. capacity, with the design so executed that the pivoting lever may be padlocked in the "off" position to prevent opening of the switch or cover by an unauthorized person, has been announced by the Trumbull Electric Mfg. Co., Plainville, Conn. The switch box is 4½ in. wide, 6⅛ in. long and 3¼ in. deep and is designed to harmonize with any surroundings.

The handle gives the switch front operation and its attached triple duty spring takes up any loose tolerance in the mechanism. The spring also provides a flexible connection to movable contacts as well as a seal between the handle and the cover. The entire switch mechanism is mounted on the back of the box and is removable by loosening a single screw.

It is available in 2-pole, 125-volt; 3-pole solid neutral, 125/250-volt; 3-pole solid neutral with meter twist-out, 125/250-volt; and a 3-pole solid neutral 125/250, 230-volt a.c.

•

Transmitting Tube Has Greater Peak Emission

A NEW TRANSMITTING TUBE in the medium power field featuring a greater peak emission and longer life has been announced by Taylor Tubes, Inc., 2312 Wabansia Ave., Chicago. With an increased filament wattage and carbon plate the tube is similar in some respects to the old 204-A, and, in many applications, is a direct substitute for the HF-300, KU-23 and the DR-300. It will find many applications in the transmitting and high-power audio fields.

Physical characteristics: over-all size —12 in. ± ⅛ in.; over-all diameter of bulb—3½ in.; over-all diameter over grid pin (brought out at side)—4¾ in.; base—jumbo 4-pin; diameter of plate connector—⅛ in.; diameter of grid connector—½ in.; filament—thoriated tungsten; plate—carbon.

General electrical characteristics: filament voltage—11 volts, d.c. or a.c.; filament current—6 amp., amplification factor—23; inter-electrode capacitances: G-P 7.0 mmf., G-F 6.0 mmf., P-F 1.4 mmf.; maximum rating for one tube; plate volts—3,000; plate current —300 milliamperes; driving power—20 watts (approx.).

•

Electronic Voltmeter Range, 50-500 Megacycles

A NEW HIGH-FREQUENCY VOLTMETER, model 32, equipped with a radio-frequency probe having an input capacity of ¾ micro-microfarad has been developed by the Alfred W. Barber Laboratories, 34-14 Francis Lewis Blvd., Flushing, N. Y., which has a range from 500 kilocycles to 500 megacycles.

It is reported to register better than 5 percent of full scale accuracy on all ranges and sinusoidal voltages. It measures 0.3 to 300 volts r.f. in five ranges (3, 10, 30, 100 and 300 volts full scale). Input impedance is ¾ micro-microfarad

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End view showing Side Wall Support of Strand by Hubeye design.

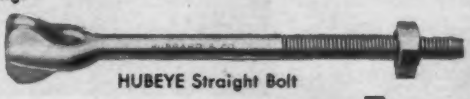
Side view showing lay of Strand in Hubeye. Fully Rounded Bearing Area is provided.

After many years of experience in producing forged eyes of all types for use without thimbles, Hubbard and Company has developed and established as its standard, the HUBEYE. This eye has received immediate approval from all Standards Engineers to whom it has been shown. Due to its universal appeal Hubbard and Company has concentrated on this design as standard for all eyes on products which involve attachments where a no-thimble eye means a saving of time, money and maintenance to users. Most of these items are illustrated or listed here.

Hubeye design consists of a rounded section of large radius around which the guy is looped. High side walls support and maintain its round shape so that no individual wire strands are subjected to excessive strain. The eye is drop forged and is stronger than the rod section from which it is made. All inner surfaces are kept smooth and are protected against corrosion by Hubbard Double-Dip Hot Galvanizing.

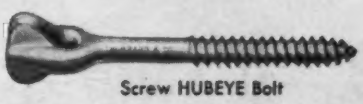
HUBEYE Anchor Rod Threaded or Drive Point and Screw Type Steel-wing.

TU-HUBEYE Anchor Rod Threaded or Drive Point



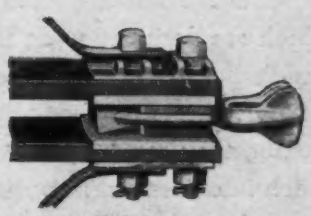
HUBEYE Straight Bolt

HUBEYE Angle Bolt



Screw HUBEYE Bolt

HUBEYE NUT (Threaded)



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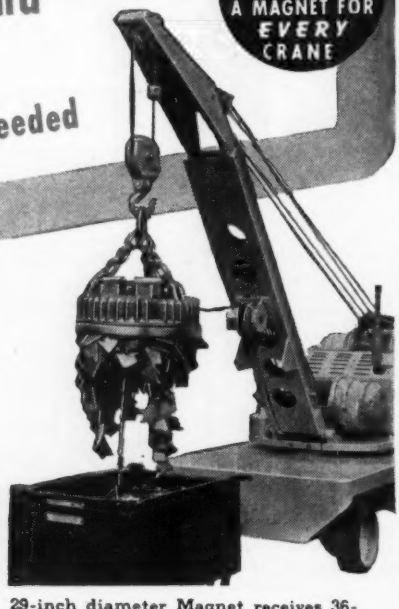
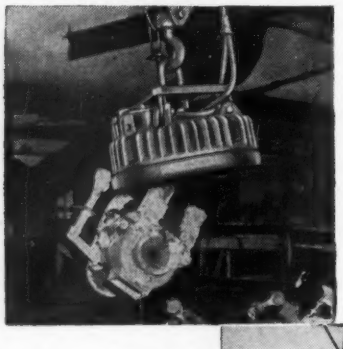
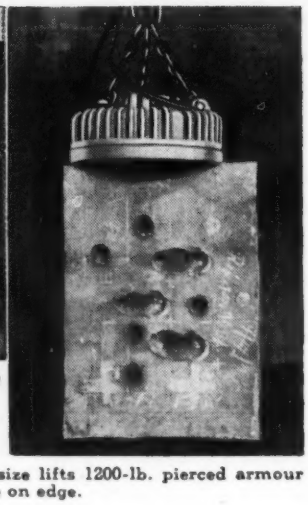


29-inch diameter Magnet receives 36-volt power directly from crane-truck.

Handling hot casting as soon as edges cool to become magnetic.



25-inch Magnet lifts heavy die-blanks on and off surface grinder.



29R size lifts 1200-lb. pierced armour plate on edge.

THESE are small magnets of 29-inch diameter and less, which are designed to do the odd jobs throughout industry. They handle hot castings from the shake-out floor and lift heavy material from floor to machine. Because of their low cost and medium weight, they can be effectively used on industrial crane-trucks to reach into corners, between machines, through narrow aisles—to cover the territory inaccessible to overhead cranes. New Bulletin 904 describes and illustrates these magnets at work. Write for your copy.

THE ELECTRIC CONTROLLER & MFG. CO.

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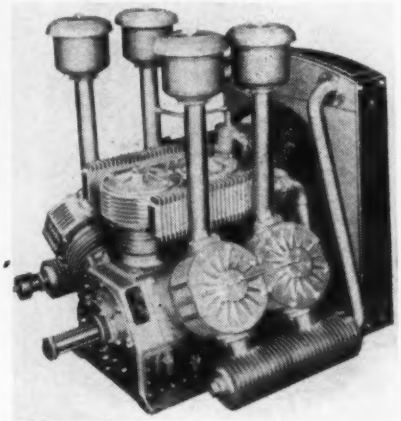
at a Q of about 200. Power supply is 115 volts, 60 cycles, 30 watts. Tubes are one 6AL5 in the probe, two matched 6J6 and one 6X5GT rectifier.

The instrument is 5½ x 9½ x 9½ in. in size, weighs 8 lb. and is suitable for general use in the laboratory, on the test bench, or on the production line.

•

New Line of Air-Cooled Compressors Developed

A NEW LINE of air-cooled portable compressors in 60, 105, 160, 210, and 315-cfm. capacities has been announced by Davey Compressor Co., Kent, Ohio.



All units are of the "V"-cylinder type design, except the largest size, which is of the "W" construction with four low-pressure and two high-pressure cylinders. The two smaller sizes have piston strokes of 4½ in. and the three larger, 4 in.

Aluminum alloys are used in compressor heads, manifolds and crankcases. Other features include crankshaft mounting on heavy-duty, double-row ball bearings, full force feed lubrication and individual air cleaners for each low-pressure cylinder.

The new models are available in industrial department, skid, steel wheel, pneumatic tired trailer, and flanged wheel units for mine and railway work. They are also available for truck mounting.

•

Electric Fixture Stud Made of Aluminum Alloy

A NEW ELECTRIC fixture stud, called "No Bolt" type FS-3, made of diecast aluminum alloy with a ⅜-in. pipe thread has been announced by Cannon Electric Development Co., 3209 Humbolt St., Los Angeles 31, Calif. It has no interior thread. The fitting has been tested to a breaking point of 600 lb. vertically. Weight is approximately 0.0193 lb.

One typical utility customer says: "I'm surprised how fast they okayed my credit and gave me service."

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NEWS ABOUT PEOPLE

Consolidated of Baltimore Elects Schmidt Chairman

At a meeting of the board of directors of the Consolidated Gas, Electric Light & Power Co. of Baltimore William Schmidt, Jr., president of the company, was also elected chairman of the board of directors to fill the vacancy caused by the death of Charles M. Cohn.

Charles P. Crane, executive vice-president, was elected a member of the board of directors and of the executive committee at the same meeting.

•

▶ M. J. McHENRY, director of promotion, Hydro-Electric Power Commission of Ontario, Toronto, Canada, has been elected president of the Electric Service League of Ontario.

▶ GEORGE A. GREGORY, in charge of construction of the Alder dam and powerhouse for Tacoma City Light at Tacoma, Wash., is leaving for China in the near future to serve as principal construction engineer for the national hydroelectric bureau of the National Resources Commission of China.

▶ WILLIAM E. CASEY, assistant manager of the Worcester County (Mass.) Electric Co., has been named temporary vice-president and acting manager of the Lawrence (Mass.) Gas & Electric Co., owing to the enforced absence for ill health reasons of R. H. Patterson of the latter company. Both are New England Power System affiliates. Mr. Casey joined this utility group in 1919 at Clinton, Mass., later going to the Leominster company and to Worcester in 1924.

▶ H. A. LOTT, operating engineer of Southern California Edison Co. since 1937, has been appointed chief of the division of electrical engineering. P. H. GILBERT has been named to succeed Mr. Lott. Mr. Lott's Edison career dates from 1926. After holding several operating positions, he was appointed chief dispatcher, assuming the position of operating engineer almost ten years ago. Mr. Gilbert's company service began in 1917, when he joined the Pacific Light & Power Corp. at Big Creek as an assistant operator, subsequently transferring to Edison. He was appointed production engineer in 1942 and protection engineer this year.

•

Detroit Edison Co. Appoints Compton Sales Manager

Fred A. Compton, formerly purchasing agent, has been appointed sales manager of the Detroit Edison Co.,

F. A. COMPTON

and Chester F. Ogden, formerly assistant purchasing agent, has been appointed purchasing agent, to succeed Mr. Compton. Angus D. McLay, who has held the position of vice-president and sales manager since the retirement in 1943 of Miss Sarah M. Sheridan, continues as vice-president.

Mr. Compton was graduated from the engineering college of the University of Michigan in 1914. He has since that date been in Detroit Edison's construction and purchasing departments except for service as an officer in World War I. He was active in a utility material procurement and exchange program, working with the government and other utilities in the Second World War at the request of J. A. Krug, then director of the Office of War Utilities. Since 1939 he has had charge of purchases at Detroit Edison.

Mr. Ogden has been with Detroit Edison since 1934. During the war, he was active in the company's rationing programs and in continuing the company's standardization of purchased items.

Virginia Utility Makes New Engineering Assignments

Personnel changes in the organization of the Virginia Electric & Power Co., have recently been announced.

FORREST U. ROSS, formerly manager at Portsmouth in the Norfolk district, has been appointed assistant vice-president of the eastern division, with headquarters in Norfolk. A. LEROY JAMESON, formerly director of customer installations in the system sales department at Richmond, has been appointed manager at Portsmouth.

ROGER S. WALKE, formerly district superintendent of the Richmond district, was transferred to the system engineering department as budget engineer, succeeding RAYMOND HUNT, retired.

ROBERT C. DAFFRON, formerly assistant district superintendent of the Richmond district, has been appointed district superintendent of the Richmond district.

CHARLES S. BETTS, JR., formerly assistant superintendent of transmission in the system operation department, has been appointed superintendent of transmission of the system operation department, succeeding W. H. HEINTZMAN, retired.

FREDERICK J. ZAK, who recently returned from active duty in the U. S. Army, has been appointed supervisor of distribution engineering in the system engineering department.

•

▶ LAWRENCE C. PORTER, pioneer in the development of numerous lamp applications, has retired after 39 years of service in many lighting fields for the General Electric Co. Starting in 1907 with the then Edison Lamp Works of G.E. in Harrison, N. J., and interrupted only by service in the Navy during World War I, Mr. Porter has been responsible for many "firsts" in lamp applications. In 1930 when the Edison and National Lamp Works were merged, Mr. Porter moved to Nela Park to be in charge of the special developments section of the engineering division, lamp department. Mr. Porter has been an active member of the Illuminating Engineering Society for more than 35 years, fulfilling numerous committee assignments and contributing many notable

papers. He is a fellow of the American Institute of Electrical Engineers and chairman of the Cleveland Section, a fellow of the American Association for the Advancement of Science and a member of the Society of Automotive Engineers.

► E. H. LEWIS, formerly executive vice-president, is now president and treasurer of Western Insulated Wire Co., Los Angeles, Calif. Mr. Lewis is active in the wire and cable division of the National Electrical Manufacturers Association.

► C. E. ALLEN, formerly assistant general manager, has been elected vice-president and general manager of the Sawyer Electrical Mfg. Co. of Los Angeles. Mr. Allen originally joined the Sawyer Co. as chief engineer.

► OSCAR L. BOWDEN has been appointed production superintendent of the Standard Transformer Co., Warren, Ohio. Mr. Bowden joined Standard Transformer after 15 years of service with the Cities Service Co. He was most recently connected with the Ohio Public Service Co. at Lorain, Ohio.

► F. ELLIS JOHNSON, formerly dean of the colleges of engineering at both the University of Missouri and the University of Wisconsin, has been placed in charge of educational activities at the Hanford Engineer Works at Richland, Wash. The management of the Hanford Engineer Works, organized by the E. I. duPont de Nemours Co. for the United States for the further development of atomic energy, was recently taken over by the General Electric Co. and assigned to its chemical department. Mr. Johnson is a fellow of the American Institute of Electrical Engineers, has served as a member of its board of directors and is a past-chairman of the national committee on education and the committee on student branches. Mr. Johnson is also a member of the Engineers Council for Professional Development and of the Society for the Promotion of Engineering Education.

► ERNEST L. WARD has been elected a vice-president of the Sprague Electric Co., North Adams, Mass. Mr. Ward, who became affiliated with Sprague in early 1946 as a member of the company's executive staff, includes among his new duties the coordinating of the manufacturing and service activities of the company. He was previously in the investment banking field, specializing in industrial operations and organization, and immediately prior to joining the Sprague company was a partner with F. S. Moseley & Co., Boston, Mass. LEON PODOLSKY has been

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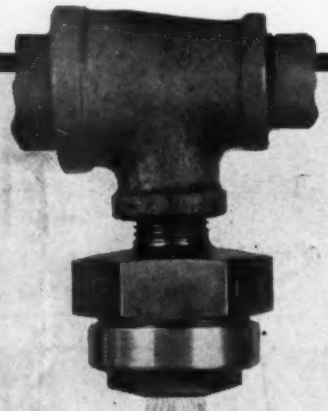

Ideal for fixed sprinkler installations—the new Blaw-Knox Aquatomic Nozzle *blankets, cools* and *quenches*—free flowing and non-clogging—maintains pattern at reduced pressures—a real advance in nozzle design.

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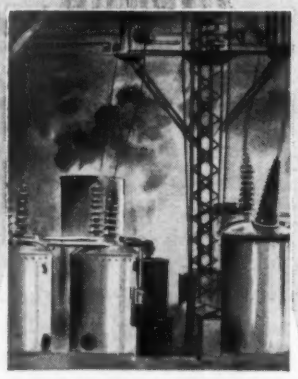

BLAW-KNOX

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appointed manager of the field engineering department. He was formerly chief engineer of the Wiert Co., Philadelphia, and an independent consultant.

▶ THOMAS B. RICHARDS, superintendent of Pennsylvania Power & Light Co. plants in Harrisburg, Pa., has been appointed superintendent of the new $30,000,000 steam electric station now under construction at Sunbury, Pa. RICHARD FORBES, superintendent of the Cedar plant in Harrisburg, has been appointed to succeed Mr. Richards in his present Harrisburg position. Mr. Richards began his association with Pennsylvania Power & Light 18 years ago as a junior engineer, and after filling various technical positions in the company's Pine Grove and Hauto plants went to Harrisburg in 1941 as supervisor of the Cedar Street plant. Upon the retirement of J. B. MacFarlane in 1944, Mr. Richards was appointed superintendent of plants for the Harrisburg area. Mr. Forbes joined the utility in 1924 in Williamsport.

▶ P. E. MCCHESNEY, for five years manager of the Helena-Marianna district of Arkansas Power & Light Co., has been elected vice-president of the Capital Transportation Co., wholly owned subsidiary of A.P.&L. in Little Rock. The office was recently created by the board of directors.

OBITUARY

▶ CHARLES B. THWING, pioneer in the field of pyrometry and president of the Thwing-Albert Instrument Co., Philadelphia, died on December 12 at the age of 87. Born at Theresa, N. Y., Dr. Thwing was an eminent physicist and the holder of numerous patents in the field of thermo-electricity. A graduate of Northwestern University and the University of Bonn, Germany, Dr. Thwing was active in the field of education prior to entering business. Included in Dr. Thwing's research was early work in the development of the electric light and wireless. He also formulated Thwing's Law on capacity.

▶ ALMA HENRY WEST, 62, manager of the Utah Power & Light Co. power plant in American Fork canyon, died on November 11 of a heart attack. A veteran of 40 years' employment with the company, Mr. West was superintendent of the Idaho Falls, Idaho, plant until seven years ago, when he moved to American Fork, Utah.

▶ ARVID PETERSON, engineering executive and a director of the De Laval Steam Turbine Co., died in Trenton, N. J., on December 19 after a brief ill-

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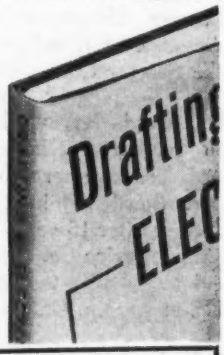

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By

L. F. B. Carini, Formerly United States Coast Guard Reserve, Communications Engineering Division, Coast Guard Headquarters, Washington, **211 pages, 6 x 9, 186 illustrations, $2.50.**

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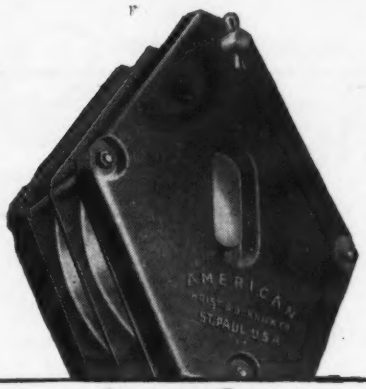

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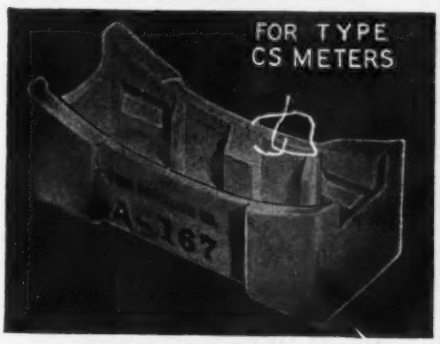

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ness. Born in Sweden, Mr. Peterson had been with the company for 39 years and was considered a leading technician in his field. At the time of his death he was the chief engineer of the centrifugal pump and compressor department.

▶ JOHN A. PEEPLES, superintendent of the city power plant at Bartow, Fla., died at his home in that city on November 27 after a brief illness. Mr. Peeples was 51 years old.

▶ HERBERT L. MORRIS, 48, a sales supervisor on the staff of the Lawrence (Mass.) Gas & Electric Co., died suddenly in that city on December 12. His duties were primarily in the field of home applications of electricity, and he was well known in the northeastern district of the New England Power System.

▶ ASA R. SMITH, lighting engineer for the Georgia Power Co., died at his home in Atlanta on October 29 at the age of 49. Mr. Smith had been identified with Georgia Power Co. for 13 years and was formerly Macon division lighting engineer and served for a period with the company in Rome.

▶ WILLIAM CARPENDER, sales executive of the Carrier Corp., Syracuse, died suddenly in New York on November 27, while on his way to the New York offices of the corporation in the Chrysler Building. Mr. Carpender joined Carrier ten years ago. He was born in New Brunswick, N. J., 58 years ago.

▶ WILLIAM B. GOLD, purchasing agent, Electric Storage Battery Co., Philadelphia, died suddenly on December 15 at the age of 66. He entered the employ of the company in 1900 and in 1913 was made purchasing agent. Mr. Gold was one of the organizers of the Philadelphia Association of Purchasing Agents and served as its president and director for several years. He was also a founder of the National Association of Purchasing Agents, serving as its vice-president and director.

▶ R. E. POST, for many years representative of Fairbanks, Morse & Co. and for the past decade manager of its Washington, D. C., office, died in that city on November 13 after a month's illness. Mr. Post was born in Wilmington, N. C., 69 years ago, and received his education at the Stevens Institute of Technology, Hoboken, N. J. Starting with the E. and T. Fairbanks & Co., he joined Fairbanks, Morse & Co. in 1923 when the two companies were merged. For many years he was manager of the Baltimore branch before going to Washington.

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Electrical Manufacturing Leaders Optimistic About Business in 1947

Qualified by Possibility of Labor and Material Troubles—Demand for Heavy Apparatus Expected to Keep Plants Busy Throughout '47—Buyers Market in Appliances by Mid-year Seen

An optimistic outlook for the electrical manufacturing industry in 1947, qualified only by the possibility of major labor disturbances and some material shortages, was being expressed by several leaders of the industry as 1946 drew to a close. R. Stafford Edwards, president of NEMA, reported that the demand for heavy equipment is "especially strong" and it was characterized as "real." Backlogs of apparatus are sufficiently heavy to carry manufacturers of apparatus well through 1947 at capacity production, he added.

General Electric Backlog

Charles E. Wilson, president of General Electric, reports a backlog of nearly one billion dollars with current operations running at about $900,000,000 per year. Output is running at approximately 225 percent of normal pre-war rate. Carrier Corp. faces 1947 with the largest backlog of orders in its history, Cloud Wampler, president, made known. The company booked $40,000,000 worth of orders during 1946 but, due to shortages of material, completed contracts and sales totalled only $23,000,000, Mr. Wampler stated.

Operating loss of Westinghouse will approximate $50,000,000 for 1946, Gwilym A. Price, corporation president, reports. Even after carry-back feature of the war-time tax laws has been taken into consideration, net income on $254,338,189 of sales in the first eleven months of 1946 is but $4,411,481, he stated.

On the brighter side, Westinghouse approaches 1947 with orders amounting to $573,069,453 on its books. Mr. Price stated "that the company was still operating at a loss near the end of the year, largely because of higher labor costs and material shortages and the further fact that because of the long production period of some of our apparatus we are still producing and shipping products at previously contracted prices which were at or below those of 1939." He concluded by stating, "Westinghouse has made substantial progress during 1946 in its $132,000,000 post-war expansion and reconversion program. We now have more business than ever before in peace time; we have the increased facilities to set new production records if material shortages are overcome; and we have more than 96,000 employees to do the job. For the nation and the company 1947 can be the most productive of all our years."

Mr. Wilson also expressed confidence in the future but added a note of caution on general wage increases. Evidence of sales resistance is already being felt, he added, which precludes additional increases. However, if wages rise generally, component parts, materials and therefore completed assemblies will rise in cost and therefore have to sell for more. Some might thereby be priced out of the market, he concluded.

Buyers' Market Predicted

This thought was amplified in Mr. Edwards' statement thus, "In the field of household appliances, the feeling is expressed that pent-up demand will be tempered by the purchasers' ability to buy and the competition for the consumer dollar offered by other durable goods industries. In this respect, a buyers' market was generally predicted by the middle of 1947."

The major household appliances were conceded to have the best possibilities for a sustained market, with the smaller appliances already facing selective consumer buying, he continued. In any case, it was felt that the backlog of demand was not as sound as in the apparatus field, and that appliance purchases will not actually be as great as the estimate made by some.

While shortages of raw materials constituted one of the two principal factors in retarding 1946 production, the availability of copper, steel, lead, castings, nickel, cotton and plastics may show some improvement in 1947, according to most opinions, although not in sufficient supply to meet the demand. It was further pointed out that this problem was directly coupled with labor conditions, the second major crippling influence in 1946, and that the same situation might loom as a possibility in 1947.

For example, even though the copper supply might show some improvement, its production for use by the electrical manufacturing industry might easily be bottled up in the rolling mills by labor difficulties, as was the case in 1946. The opinion was expressed by some wire and cable manufacturers that while copper would not be any more plentiful in the first half of 1947 than in 1946, improvement may be expected in the last half. The same condition was forecast for steel products and castings, especially sheet steel used in major appliances, and special steel used in motor laminations.

Materials Still a Problem

The supply of lead, cotton, and plastics, short in 1946, is expected to show some improvement but still far from sufficient to meet the demand. The shortage of lead and copper was characterized as world wide. The shortage of plastics will be due principally to delays in completing chemical plants to provide the ingredients for plastic materials, such as phenol and formaldehyde.

Outlook for a reliable labor supply in 1947 was described as uncertain, and dependent upon a number of factors, the most important of which is the attitude of labor itself and the need for a realization that full production is the only sound method of bringing wages and living costs into real balance.

With labor productivity viewed as the key to the 1947 output, most manufacturers felt that there had been very little increase in labor productivity in the past six months, while one or two had noted a slight improvement. It was pointed out that improved man-hour production was coming more from technological developments and machinery

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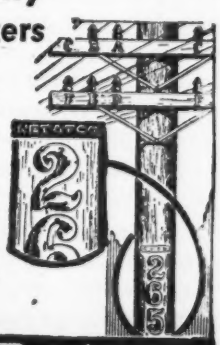

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than from any increased effort and interest by labor itself.

Improvement in labor-management relations in 1947, it was felt, will depend to a large extent upon the type of legislation enacted by the new Congress, especially as it relates to equality before the law for management and labor, and the establishment of true collective bargaining.

While new large-scale wage demands in 1947 would have a serious effect upon the picture, Mr. Edwards said that there was some optimism in the industry that the problem could be solved through equitable legislation, by increased productivity, by a better understanding of the problem on the part of labor and by more general cooperation in fighting a wage-price inflation spiral.

The consensus among the manufacturers is that a depression or even a temporary recession in business, predicted in some quarters for the latter part of 1947, can be averted if the bright spots now evident become dominant in the 1947 picture.

Bright Spots Summarized

Mr. Edwards summarized these bright spots as the substantial demand for goods and services, held in check during the war and also during 1946 by production difficulties; the very large backlog for heavy apparatus, as well as a demand for consumer goods which had prospects of continuing well into the middle of the year; an improved supply of materials, and signs of a better balance in the labor picture.

Factors which could throw the economic machine out of balance, he said, would be excessive wage demands with an attendant wage-price spiral; work stoppages which would affect the supply of materials and component parts all along the line, throttling the production of finished goods; and the failure of labor and management to cooperate to the fullest extent.

High costs and shortages would also restrict the amount of capital to be invested in the expansion of plant facilities in 1947, he said, pointing out that plans for such investments are showing indications of being postponed by management where feasible until 1948.

•

Output Capacity Doubled

The mechanical refrigeration and air-conditioning industry now has the capacity to produce two to three times the volume of equipment that was manufactured before the war, and its sales outlook indicates an even greater rate of growth in the next five years, the Refrigeration Equipment Manufacturers Association revealed recently.

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EDITORIAL DEPARTMENT

ELECTRICAL WORLD

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(*Continued from page 51*)

charges in the comparison."

Mr. Wright: "For instance, one of your basic criticisms is the same old private utility argument against all federal power development—that power can be produced cheaper by steam generation than by a combination of hydroelectric and steam generation. In order to arrive at the conclusion, the article has erroneously used the same operation and maintenance cost rate for the steam plants of the all-steam system as for the steam plants of the steam-hydro system. This rate would be higher for the all-steam system than for the steam-hydro system because the steam plants of the all-steam system would be required to take the load variations normally carried by the hydro plants of the steam-hydro system. Your comparison is grossly unfair in that you do not state that in the case of our report the figure used includes transmission costs, while the cost of steam energy production as shown in your report does not include transmission costs. It is generally conceded that a transmission grid system is necessary and will be built if this entire area is to receive the benefits to which it is rightfully entitled from these federal projects. In making your comparison you did not, for some reason, see fit to include this important item. . ."

Mr. Fell: "It is obvious that public financing makes possible lower-cost steam energy production than private financing. The government, however, is not primarily in the power business. Power is produced at these multiple-purpose projects as only one of several benefits. The chief interest of the federal government in the projects is conservation. Consequently the value of the energy is not what the government cost of production by other means would be, but the cost to others to produce. The report clearly states that the figure of 4.13 mills was adopted solely for the purpose of setting up safe rates for the interim period pending the determination of reliable cost figures. These projects are authorized by the Congress only if the production costs will be less than the value of the product. Therefore, final average costs will necessarily be less than the 4.13-mill value used as the basis for the rates, and there is no support for the supposition that even government-owned steam plants can produce energy more cheaply than the hydro plants. Your writers in preparing the table headed '20-Year Operation' should have known that the figures used in the comparison are not on the same basis, nor were they intended to be.

"You have used SPA estimates of cost of production of energy in government-owned steam plants. Perhaps you do not know that these costs are below the average cost of production in existing plants. This is because the hydro capacity is of such nature and so located as to make possible favorable location of the steam plants in areas where fuel is cheap and plentiful. It would not be possible to accomplish this without the hydro plants; therefore it is beside the point to argue that steam plants should replace the hydro merely because of lower initial investment. The economy comes about through hydro-steam coordination. The steam is treated by the government as a useful auxiliary to the hydro capacity. Only enough steam capacity is proposed to secure to the government the benefits of the integration and prevent its monopolization by private groups."

Mr. Wright: "The ELECTRICAL WORLD also contends that no power system with its own capacity can pay more than fuel cost. This is true, but you did not state that when a power system does not have the necessary capacity it will pay an amount equal to or somewhat lower than its overall production costs for power. Nor did you state that a power system will pay far more than its average costs for capacity and for standby as now provided by the Norfork and Denison projects. You did not even mention the fact that all of the operating electric utility companies in this area have made an offer to buy not only this power, but also all of the power that will ever be produced at the various dams that will be built in this territory. They also offered to pass on as benefits to the power consuming public the savings that would accrue to their companies as a result of the purchase of this hydroelectric power at a cost lower than it would cost them to produce the power by other means. Neither did you mention the fact that at the present time the Texas Power and Light Co. and the Oklahoma Gas and

Electric Co. are purchasing the entire firm output of the Denison Dam project under arrangements made during the war for 5 mills a kw.-hr. and as a result have made rate reductions to their consumers in excess of $400,000 a year. Nor did you mention that the Arkansas Power and Light Co. is purchasing the entire output of the Norfork Dam project under similar arrangements and that they have contracted to give rate reductions to their consumers amounting to $150,000 a year. This article is noteworthy for what it did not say."

Mr. Fell: "The report assumes that a large part of the hydro output will be sold as peaking power to the private companies in the region. It is surprising that you contend that the proposed hydro plants would have to compete only with incremental operating costs in existing plants. It would seem that you believe that no new generating capacity will ever be needed in the area. By making unnecessary the construction of a large part of the steam capacity which would otherwise be needed, the hydro projects would forestall the investment costs as well as the operating costs. It may be pertinent here to paraphrase your own remark by stating that this consideration evidently did not enter into the thinking of your editorial writer.

"In any event, the question of whether the private electric companies can afford to buy this power at the rates offered in the report has been settled by the offer made by eleven private companies in the Southwest on February 18, 1946, to purchase the entire output of the projects at the values estimated by the Federal Power Commission, which are the same values used as the basis of the rate schedules in the report.

"In all of your remarks on the subject of dependable capacity you have implied that the factors you mention were not considered in determining the dependable capacities are not there. This you do by omitting consideration of the effects of the large storage provided at these projects, and the daily and seasonal load variations which make it desirable to operate these plants as peaking plants. Thorough studies of the projects were made by the War Department, the Federal Power Commission, and the Southwestern Power Administration; the dependable capacities listed in the report are the result of these studies. Preliminary investigations of the effects of interconnection and integration indicate that both the dependable capacity and the firm energy will be increased more than 10 percent by such interconnection and integration.

"Present construction costs are greatly inflated, as everyone knows. They are about 30 percent above 1941 levels, according to current indexes. A similar sharp rise was experienced after the last war, followed by a sharp drop of approximately 30 percent to an average level, which continued, with occasional dips, for 13 years. The construction costs estimated for the report were prepared during 1945 and are somewhat above average costs for that year. Assuming even a moderate decline in the direction of normality after current inflation, these costs are more than adequate for the 20-year period."

Mr. Wright: "The ELECTRICAL WORLD's other principal criticism of our report has to do with the adequacy of the cost estimates. Even if costs do increase over the 1945 level, as contended in this article, it is generally accepted that these increases will be reflected to a greater extent in the production cost per kw.-hr. from steam plants where the cost of fuel and labor have a greater bearing on operating and investment costs, than in hydro plants. No mention is made in this article of the value of hydro projects in retarding cost per kw.-hr. in a period of rising prices. It is rather common knowledge that prices go up after a war, then retard and level off. There is little doubt but that history will repeat itself and that this condition will prevail after the greatest demand of all time for materials and labor has been satisfied.

"Casting aside all of the red herrings, the real issue in this controversy is whether this power from these federally constructed dams is to be sold at the busbar which means in practically all cases to the privately owned electric utilities on their own terms and for their own financial gain, or whether the federal government, which builds and pays for these dams, shall transmit and dispose of this power, a byproduct of such development, at cost and in such man-

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ner as to bring about the greatest public benefits in accordance with the mandates of the Congress. That is the issue and the only issue involved.

"In accordance with the American tradition of presenting both sides of any controversy, I respectfully request that this reply to your article be published with the same prominence given your unfair attack upon the Southwestern Power Administration."

•

Manufacturers Issue Earnings Reports

Among the electrical and allied manufacturing companies which have recently issued statements of earnings are the following:

ELLIOTT CO.—With a backlog of unfilled orders on September 30 totaling $18,600,000, as compared with $10,800,000 at the end of last year, company reports loss of $235,100 for nine months ended September 30, compared with a net profit of $341,485 for the same period of 1945. Sales for nine-month period ended September 30 of this year amounted to $6,880,685, compared with $16,478,385 for the nine months ended September 30, 1945.

COPPERWELD STEEL—For nine months ended September 30, net income $188,727 after crediting to income $165,796 representing a pro rata share of reserves charged against operations in prior years and after provision of $148,569 for federal and state income taxes. After allowance for dividends on preferred stock in the amount of $62,229 this income is equivalent to 25 cents per common share on 514,864 shares of common stock outstanding. First nine months of 1945 showed a net income of $525,628 after provision of $326,536 for federal and state income taxes, equivalent to 90 cents per common share on the same number of shares outstanding.

LA CONSOLIDADA—For nine months ended September 30, net profit after income taxes equal to $957,996. After allowing for 8 percent dividend tax, this is equal to $5.34 per preferred share and to $1.72 a share on common. For six months to June 30, net profits after income taxes were $577,385 which, after dividend tax, was equal to $3.20 a share on the preferred stock and to $1.01 a common share.

CONTINENTAL-DIAMOND FIBRE—Including wholly owned domestic subsidiaries, nine months, net loss, $57,734, contrasted with net profit of $300,231 in 1945 period.

MCGRAW ELECTRIC—Twelve months to September 30, net profit $1,381,894, or $2.92 a share on 472,600 shares, compared with $824,760, or $1.74 a share, for preceding twelve months, for which the net was adjusted to reflect renegotiation settlements for 1944 and 1945.

NOMA ELECTRIC—Including subsidiaries for first ten months, net profits of $1,476,169 after taxes. Sales for the ten months were $23,607,700.

Recent Rate Changes

FREMONT (NEB.) CITY COUNCIL has approved electric rate reductions expected to save Fremont power users approximately $14,000 a year. The adjusted rates, applicable to residence, commercial and secondary power, became effective January 1.

ARKANSAS POWER & LIGHT CO. reached an agreement with its rural electric cooperative customers on the main provisions of a new schedule at a recent state Public Service Commission meeting. The main provisions are: (1) Retention of the present farm and farm-processing rate averaging 5.6 mills per kilowatt-hour; (2) Removal of the "ratchet clause", to which cooperatives objected, because they said under it they were charged throughout the year on the basis of 65 percent of the power used during the month of maximum load; (3) Addition to the schedule of an industrial rate under which cooperatives would receive power at the same price as Arkansas Power & Light retail customers, less a 20 percent discount.

RANDOLPH ELECTRIC MEMBERSHIP CORPORATION, Asheboro, N. C., which embraces the five counties of Randolph, Chatham, Alamance, Moore and Montgomery, has approved a plan for reduction of rates. The reduction would bring to members more than $10,000 savings, the new schedule calling for an over-all reduction of 10 percent. This is the first rate reduction the R.E.M.C. has effected.

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Aluminum Solder Corp. Organized; Reeves Heads

Formation of the Aluminum Solder Corp., manufacturers and distributors of solder developed in Switzerland during the war, has been announced by Hazard E. Reeves, president. Mr. Reeves, founder and former president of Reeves-Ely Laboratories, Inc., is now president of Reeves Sound Studios, Reeves International, Inc., Reeves Soundcraft Corp., and the Alni Corp.

Other officers include: Marian W. Schwartz, vice-president in charge of sales; Homer W. Clapper, vice-president in charge of production; Werner J. Fleischmann, treasurer, and Col. R. C. Marshall, 3rd, secretary.

The company will maintain offices in the Reeves International Building, 10 East 52nd St., New York, N. Y.

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Neco Mfg. Co. Organized

Articles of incorporation have been filed with the Indiana Secretary of State by the Neco Manufacturing Co., Inc., Auburn, Ind., organized to manufacture transformers for electrical apparatus and appliances. The corporation has 1,000 shares of no par value capital stock and the incorporators are: Park E. Rousey, Helen M. Rousey and Robert Mayer.

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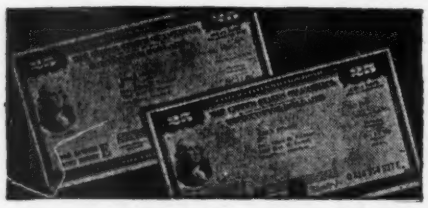
The moral was plain to most. Here was a new, easy way to save; one as well suited to the future as to the past. Result: Today, millions of Americans are continuing to buy, through their Payroll Savings Plan, not War Bonds, but their peacetime equivalent—*U. S. Savings Bonds.*



From war to peace! War Bonds are now known as U. S. Savings Bonds, bring the same high return—$25 for every $18.75 at maturity.

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	In 1 Year	In 10 Years
$ 3.75	$195.00	$2,163.45
6.25	325.00	3,607.54
7.50	390.00	4,329.02
9.38	487.76	5,416.97
12.50	650.00	7,217.20
15.00	780.00	8,660.42
18.75	975.00	10,828.74

Savings chart. Plan above shows how even modest weekly savings can grow into big figures. Moral: Join your Payroll Savings Plan next payday.

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